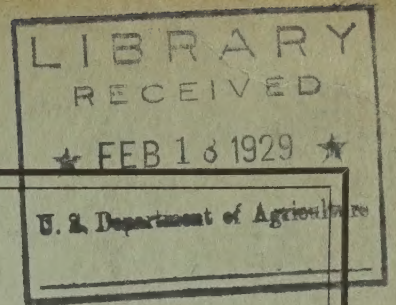


Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

1
RS3Rp
26



REPORT

OF A

SURVEY OF TRANSPORTATION

ON THE

STATE HIGHWAYS OF PENNSYLVANIA

BY

THE BUREAU OF PUBLIC ROADS
U. S. DEPARTMENT OF AGRICULTURE

AND

THE DEPARTMENT OF HIGHWAYS
OF THE
COMMONWEALTH OF PENNSYLVANIA

1928

REPORT
OF A
SURVEY OF TRANSPORTATION
ON THE
STATE HIGHWAYS OF PENNSYLVANIA

BY
THE U. S. BUREAU OF PUBLIC ROADS
AND
DEPARTMENT OF HIGHWAYS
OF THE
COMMONWEALTH OF PENNSYLVANIA

1928

TABLE OF CONTENTS

CHAPTER I	
Foreword	Page 7
Purpose of the Survey and Major Conclusions	10
Principal Characteristics of Pennsylvania	15
Amount and Character of Present Highway Traffic	24
Forecast of Future Highway Traffic	
CHAPTER II	
The History of Highways in Pennsylvania	32
The Development of the State Highway System	35
Organization of the Department of Highways	39
Road Maintenance	42
Road Construction Policies	45
CHAPTER III	
The Highway Transportation Survey	47
The Density of Motor Vehicle Traffic in 1924	50
The Density of Motor Truck Traffic	65
Loaded 5 to 7½-ton Truck Traffic	68
Concentration of Truck Traffic Around the Large Cities	69
The Effect of Small Population and Mountains in the Northern and Central Section of the Commonwealth	71
Motor Truck Loading	72
CHAPTER IV	
Highway Utilization	74
CHAPTER V	
Composition of Highway Traffic	75
Passenger Cars	75
Motor Trucks	78
CHAPTER VI	
Highway Traffic and Population	81
CHAPTER VII	
Forecast of Highway Traffic	91
APPENDICES	
I. Commodities Transported	96
II. Motor Vehicle Traffic at Transport Survey Stations	98
III. Average Daily Density of Loaded and Empty Truck Traffic, by Capacity Groups	109
IV. Sections of the primary highway system on which the density of motor truck traffic was more than 200 per day	114
V. Sections of the primary highway system on which the density of loaded 5 to 7½-ton truck traffic in 1924 was 5 or more per day	115
VI. Average gross weight of loaded trucks by capacity groups	116
VII. Average daily density of loaded truck traffic by gross weight groups	117

LIST OF FIGURES

Figure Number		Page
1	Relief Map of Pennsylvania Showing State Highway System	9
2	Pennsylvania State Highways Included in the Authorized Routing for Common Carriers of Freight and Passengers Operated Under Certificates of Public Convenience Issued by the Pennsylvania Public Service Commission	23
3	Organization and functional chart of the Department of Highways, Commonwealth of Pennsylvania	38
4	Map of Pennsylvania showing the location of traffic survey stations (west section)	48
4a	Map of Pennsylvania showing the location of traffic survey stations (east section)	49
5	Map of Pennsylvania showing the average and maximum daily traffic on the Primary Highway System	51
6	Mileage of State highways by traffic classes	52
7	Map of Pennsylvania showing traffic and population sections and sub-divisions. Traffic sections separated by heavy solid lines, sub-divisions by light solid lines	53
8	Map of Pennsylvania showing average daily density of motor truck traffic on the Primary Highway System	66
9	Mileage of primary highways by truck traffic classes	67
10	Mileage of primary highways carrying various numbers of loaded five to seven and one-half ton trucks daily	69
11	Comparison of total traffic on the primary, secondary and other rural highways	75
12	Traffic density on the primary, secondary and other rural highways	75
13	Density of population and density of motor vehicle traffic on State highways by sections of the Commonwealth	83
14	Daily traffic on State highways per person and per registered motor vehicle by sections of the Commonwealth	86
15	Trends of highway traffic and motor vehicle registration in Massachusetts, Maryland, Maine, Wisconsin and Michigan	92
16	Motor vehicle registration and persons per car	94

FOREWORD



This report contains the results of highway traffic studies of the State primary, secondary and State-aid road systems of Pennsylvania conducted during 1924 under a cooperative research agreement between the Bureau of Public Roads, United States Department of Agriculture, and the Pennsylvania Department of Highways.

This investigation was undertaken in order to obtain essential facts concerning traffic on Pennsylvania highways as a basis for their future development.

The first part of the report contains a summary of the principal conclusions and the second part the evidence upon which the findings of the report are based.

The researches were conducted under the joint supervision of Thos. H. MacDonald, Chief of the Bureau of Public Roads, and W. H. Connell, who until May 1, 1927 was engineering Executive and Deputy Secretary of Highways of the Pennsylvania Department of Highways. Publication of the report has been completed under the administration of James L. Stuart, Secretary of Highways and Samuel Eckels, Chief Engineer.

J. Gordon McKay Chief of the Division of Highway Economics, Bureau of Public Roads, directed the work of the survey and preparation of the report, assisted by O. M. Elvehjem, Highway Economist, E. T. Stein, L. E. Peabody and B. P. Root, Associate Highway Economists, all of the Division of Highway Economics in cooperation with W. A. Van Duzer, Assistant Chief Engineer, J. W. Follin, Office Engineer and H. K. Craig, Cost Engineer, all of the Pennsylvania Department of Highways.

THE PENNSYLVANIA HIGHWAY TRANSPORTATION SURVEY



CHAPTER I

PURPOSE OF THE SURVEY AND MAJOR CONCLUSIONS

There are in Pennsylvania approximately 93,000 miles of public roads, exclusive of city and borough streets, of which 10,719 miles were on the State highway and State-aid highway systems in 1924, and under direct supervision of the Department of Highways. Through additions to the highway systems, the mileage on January 1, 1927 was approximately 12,000. Of this mileage, about 4,000 miles have been designated as the primary highway systems which includes the connections between larger population centers, county seats and routes into adjacent states. This system is, with few exceptions, coextensive with the Federal-aid highway system. The remainder, or about 8,000 miles, consists of roads designated as secondary State highways and State-aid highways.

These highways serve more than 9,000,000 people scattered over 45,000 square miles of territory and included within 67 counties, 42 cities, 931 boroughs and 1,571 townships.

In 1924, 1,229,000 *Motor* vehicles were registered in Pennsylvania, representing one car to each $7\frac{1}{2}$ persons. In 1914 the registration was only 113,000, or one car to each 72 persons, which means that in ten years the registration had increased ten fold. The registration for 1926 was 1,455,000, or one car to $6\frac{1}{2}$ persons, and it is estimated that the motor vehicle registration in 1930 will be 2,086,000, which, on the basis of the estimated population of nearly 10,000,000, will represent one car to each 4.75 persons.

Prior to 1923, Pennsylvania was without fundamental traffic data and was facing a program of construction and maintenance, under the supervision of the Pennsylvania Department of

Highways, involving the expenditure of about \$260,000,000 in four years. Of this amount about \$200,000,000 was for work on the State highway system and the remaining \$60,000,000 on township and county highways. The need for traffic information which would serve as a guide to the proper expenditure of these funds in providing highway facilities for present and future traffic was self-evident. The Department undertook early in 1923 a series of traffic counts on the entire highway system and a few months later arrangements were made for a comprehensive highway transport survey to be conducted jointly by the Department and the United States Bureau of Public Roads.

Present and Future Value of Traffic Data.—The data produced in these traffic studies are valuable as a guide in determining the required strength and width of the pavements to be constructed, and in establishing the ultimate widths of right of way; and they have been so used in planning the road improvement program since 1924. These data with minor modifications from time to time, will also serve as a guide in the further development of the highway improvement program in Pennsylvania in future years.

The establishment of plans for highway development, which will result in the maximum of highway transportation service, at a cost commensurate with the service rendered, requires a careful analysis of present highway traffic and the trend of its development. The plan of improvement may materially alter the economic and social development of the commonwealth as a whole or of any section. The improvement or lack of improvement of a given route is of importance not

only as a compliance with the traffic needs of the immediate locality, but also, as a partial answer to the traffic demands of a much wider area.

Therefore, the development of a system of highways should not be judged only as miles and types of highways constructed each year, but should be considered in terms of the movement of people and commodities, both present and future. The planning and construction of a connected system of highways deal, in fact, with the development of the Commonwealth and its localities, their agriculture, industries, the growth of suburban areas adjacent to centers of population and the social activities of the people.

The Economic Highway.—The plan of highway development, to be sound both from the standpoint of the most economical design and the earning capacity of the improvement, must be based upon not only the present but the estimated future traffic demands.

Highways, no less than other engineering structures, are designed for a specific purpose. The economic structure, whether it be a bridge, building, pavement, or, in fact, any structure is one that has been designed to accomplish at least annual cost, the purpose for which it is intended. In the case of the highway, the location must accord in direction with the natural direction of traffic flow; the pavement must be of sufficient width to accommodate, with a reasonable degree of comfort, the peak of traffic in terms of the number of vehicles, and it must be strong enough to accommodate the peak in terms of the weight of vehicles using the road in a given time. On the other hand, it must be remembered that there is waste in excessive provision which is to be avoided as carefully as the waste of inadequacy. It would be a waste of money to construct a pavement of insufficient strength or width, but it is likewise a waste of money to construct one that is more costly than the traffic requires. This means not only the present traffic, but the traffic that it is esti-

mated will use the highway during the life of the pavement.

There is an accepted principle that no highway should be improved in excess of its earning capacity. The demand for improved highways will continue until all important highways are improved, yet the extent to which the various highways may be improved and yield an economic return from such improvement varies greatly, and cannot be left to the hazard of uninformed judgment, but must be determined on the basis of the present and future traffic demands. In making this determination proper consideration should be given to possible savings in vehicle operating costs for present and estimated future traffic as well as location, construction and maintenance costs. So it may be said that the economic highway is one of which every section is improved to the degree required by the traffic and to no greater degree.

Scope of the Transportation Survey.—The transportation survey, herein reported, covered a period of one year and the field studies included a count of the number of vehicles passing various points on the highway system, as separated into passenger cars, motor busses and trucks, as well as detailed information regarding the capacity, weight, and use of motor trucks, and the use of passenger cars.

On the basis of the present traffic demand the various routes of the highway system were classified as terminal, industrial and semi-industrial, and on the basis of future estimated traffic demand the same routes were reclassified to show the probable classification in 1930 and 1935. An analysis was also made of the present condition of the various routes to determine their ability to meet the estimated traffic demands and a tentative program of improvement has been prepared which, if followed, will provide adequately improved highways for the probable traffic of each of the above future periods.

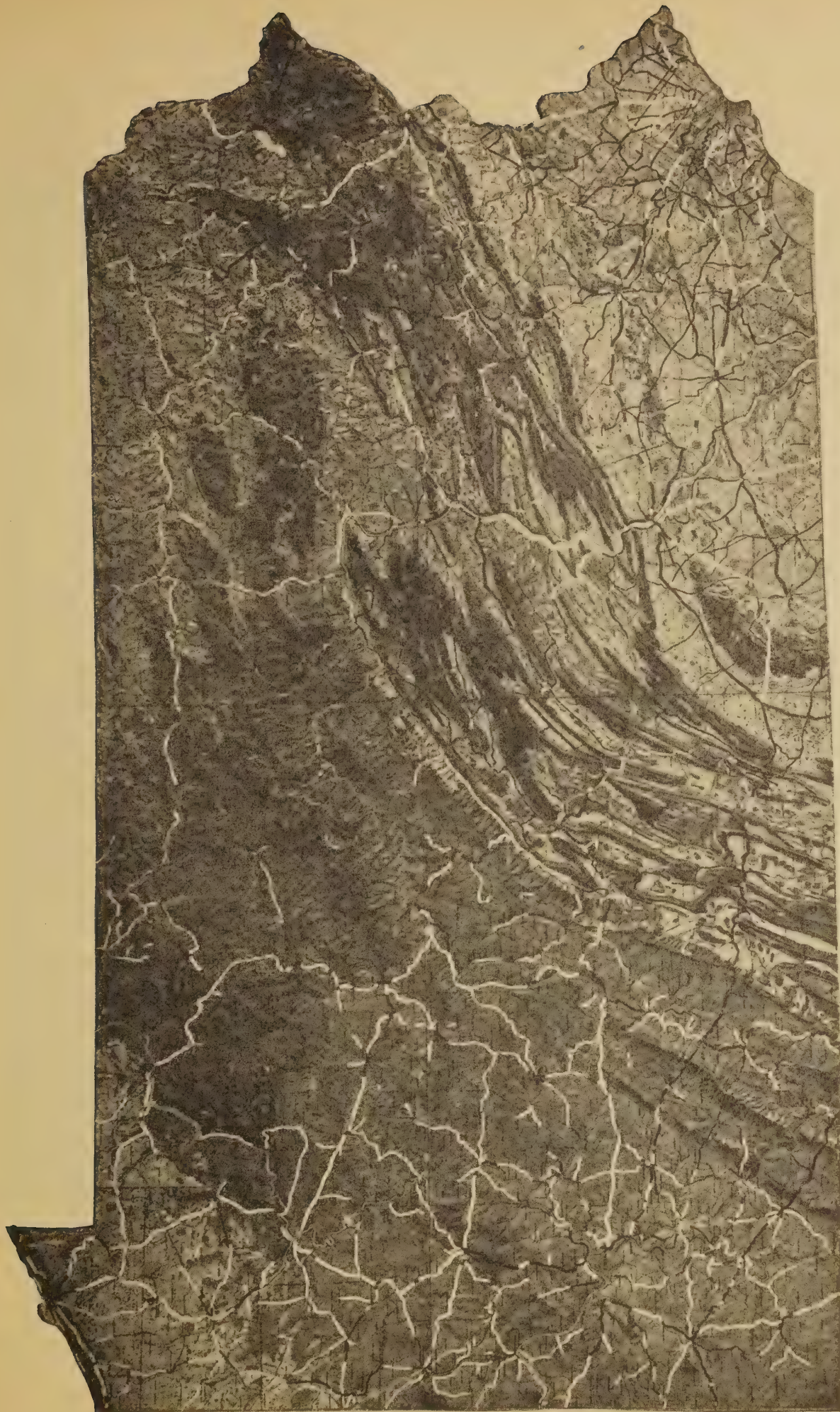


Fig. 1—Relief map of Pennsylvania showing State Highway System

PRINCIPAL CHARACTERISTICS OF PENNSYLVANIA

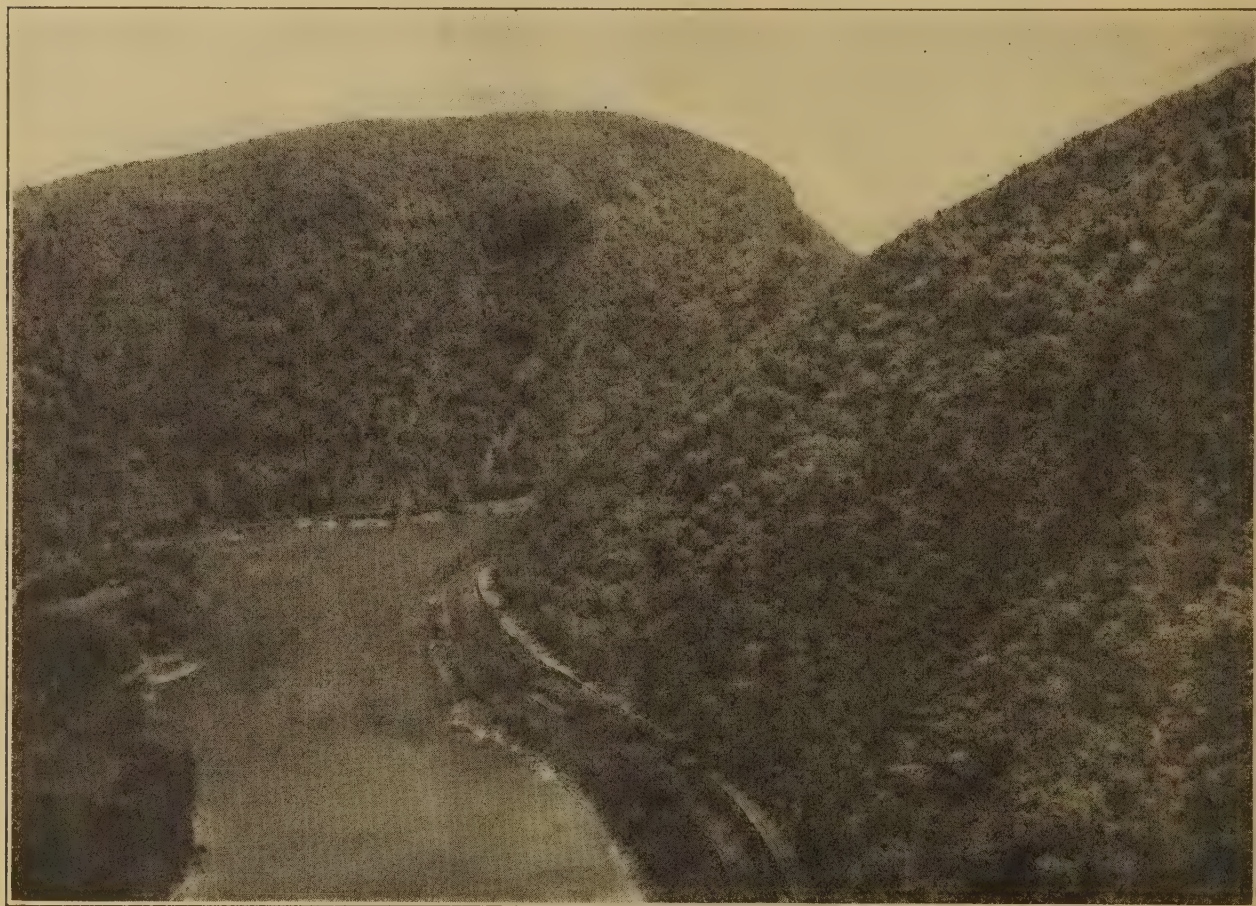
A brief description of the physical characteristics of Pennsylvania and the extent and the probable development of its principle pursuits, such as manufacturing, farming, lumbering, mining, etc., is necessary before setting forth the findings and conclusions of the survey.

The terrain is generally mountainous, as shown in Figure 1, which is a photographic reproduction of a relief model map, showing the State highway system. The mountain ranges run in a generally southwesterly to northeasterly direction through the central part and separate the eastern and western sections which are referred to frequently in the report. The area, comprising the central

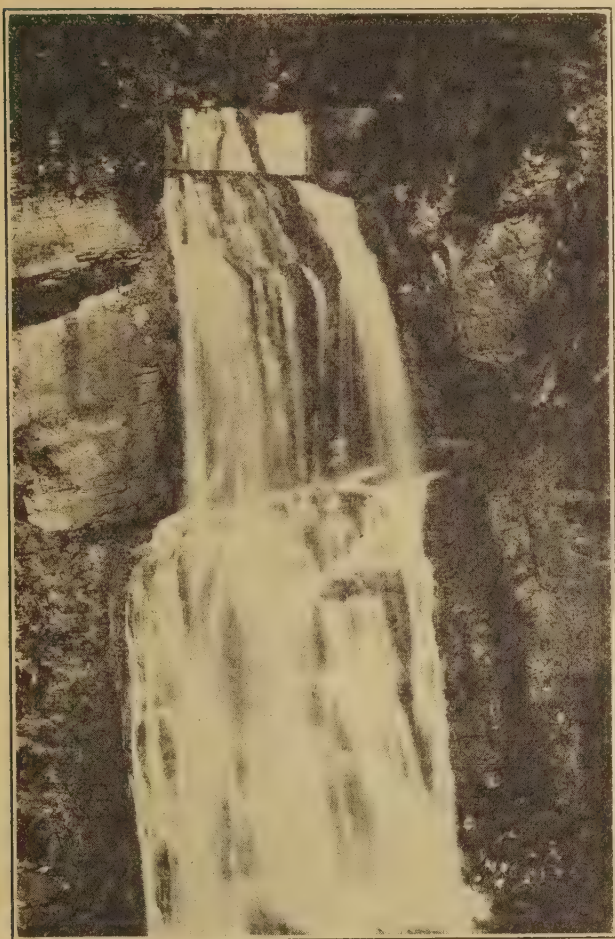
mountains and the northern territory, is described in the report as the northern and central section.

Because of the marked differences in traffic, physical characteristics, and development of these three geographical sections it has been deemed desirable to deal separately with each one of these sections, as well as with the Commonwealth as a whole.

Eastern Section.—The eastern section includes 18 counties, comprising all the counties around Philadelphia and those which surround the group of smaller cities of Lancaster, York, Harrisburg, Reading, Allentown and Bethlehem, as well as



Delaware Water Gap



Bushkill Falls Near the Highway Between Stroudsburg and Milford

the counties in which the anthracite coal mining is carried on, which include the cities of Scranton, Wilkes-Barre, Pottsville and Sunbury. Philadelphia, the largest city in this section, has a population of about 2,000,000 which gives it first rank among the cities of the Commonwealth and third place among all cities in the United States.

Western Section.—The western section of 20 counties includes all those counties along the western State boundary and others west of the Allegheny Mountains, including the cities of Pittsburgh, the commonwealth's second largest city, with a population of over 600,000, Uniontown, Washington, Butler, New Castle, Franklin, Erie, Clearfield, Johnstown and Altoona. The western section comprises the larger portions of the bituminous coal, oil and natural gas deposits.

Northern and Central Section.—This section contains the remaining 29 counties lying between the eastern and western sections. It includes all of the central counties from the southern State boundary to the northern boundary, as well as all counties lying along the northern and north-eastern boundaries. This section is generally mountainous, includes the Allegheny National Forest and most of the State forest reservations, and contains areas of great extent which are famous as hunting and fishing regions. It has comparatively few population centers, the most important of which is Williamsport, which has a population of about 40,000.

The Population, of Pennsylvania, its Growth, Distribution and Density.—From 1910 to 1920 according to the United States census the State population grew from 7,665,111 to 8,720,017, an increase of 1,054,906 persons, or 13.8 per cent; and it is estimated that the population at the time of the 1930 census will be (approximately) 10,000,000 people, which will be 14.7 per cent above the 1920 figure.

Of the total population, about 65 per cent is urban and about 35 per cent rural, as shown in Table 1.

Table 1—Urban and rural population

Class	Number of cities	1920 population	Per cent of 1920 State population
Urban			
Cities over 1,000,000	*1	1,823,779	21
Cities over 500,000 to 1,000,000	†1	588,343	7
Cities under 500,000	40	1,454,658	17
Boroughs over 10,000	39	566,798	6
Boroughs under 10,000 and other urban population ...		1,234,433	14
Total urban		5,668,011	65
Rural		3,052,006	35
Total State population		8,720,017	100

*Philadelphia.

†Pittsburgh.

In density of population, Pennsylvania ranks sixth among the States with a population of about 200 persons per square mile. The population density by counties in 1920 varied from

12½ persons per square mile in Pike County to over 13,000 persons per square mile in Philadelphia County, which is coterminous with the city of Philadelphia. The variations in population density and in population trends within the counties are also great.

There is a marked difference between the distribution of population in the three previously defined geographical sections. The eastern section includes 18 counties, with an average population density in 1920 of 457 persons per square mile and in all of these counties population increased between 1910 and 1920. The 20 counties of the western section had an average population

areas. Other areas of dense and of rapidly increasing population are found at the larger cities or boroughs, but these regions are small and scattered.

Considering the Commonwealth as a whole, 13.4 per cent of the area had a population in 1920 of 200 or more persons per square mile and contained 77.9 per cent of the total population; 11.6 per cent of the area had from 100 to 199 persons per square mile and contained 8 per cent of the total population; while 75 per cent of the area had less than 100 persons per square mile, and contained only 14.1 per cent of the total population.



Presque Isle on Lake Erie

density of 219 persons per square mile in 1920, and in 17 of these counties the population increased between 1910 and 1920. The majority of the 29 counties in the northern and central section show a very low density of population, with an average of 44 persons per square mile, and in 18 the population decreased between 1910 and 1920. The total population within this section decreased about two per cent during the decade.

The 18 counties of the eastern section, together with 9 of the 20 counties of the western section, include nearly all of the important areas of dense population and all rapidly increasing population

In general, the areas of increasing population are also the areas of dense present population. All townships having a population in 1920 of 100 or more persons per square mile increased in population between 1910 and 1920, and with the exception of certain townships in the western section in the general vicinity of Pittsburgh, the areas which had in 1920 a population less than 100 persons per square mile decreased in population between 1910 and 1920.

Economic Characteristics.—Pennsylvania's pre-eminence among the States of the Union is founded principally on the value of its industrial production, and of all the State's industries manu-

facturing easily takes first place and is therefore the controlling economic factor.

In the production of all industries, which exceeds \$11,000,000,000 a year, as well as in manufacturing, its principal industry, which according to the United States Census reports, accounted in 1920 for \$7,000,000,000 of the total. Pennsylvania is second only to New York. In the production of pig-iron it is the leading State, and in the value of its textile products it ranks third in the Union.

Mining, for many years the most important industry, has decreased in importance in recent

While practically all the anthracite coal in the United States is still produced in an area of about 480 square miles in eight counties of the east-central and northeastern sections of the Commonwealth and although the production amounted to 89,000,000 tons in 1920, the indications are that the maximum production has been reached or is about to be reached, and that during the next fifteen years the average will probably amount to only about 75 per cent of the peak production.

Bituminous coal mining is in much the same condition. This industry involves almost the en-



An anthracite Mine East of Tamaqua in Carbon County

years, both in respect to the number of persons engaged and the value of its products. Only about 10 per cent of the persons now engaged in productive industry in Pennsylvania are occupied in mining and quarrying operations. This is not to say, however, that mining is no longer a very important industry, but rather that its once supreme position among the industries of the State has been taken by the manufacturing industries.

tire western half of the Commonwealth, where some 20,000 square miles are underlaid by deposits. The producing fields cover approximately 14,000 square miles and their production in 1920 reached 170 million tons or 31 per cent of the total for the United States. While it can not be said that the maximum production has been reached, the relative importance of the Pennsylvania bituminous coal industry will probably not increase perceptibly.



A View in Franklin County Typical of the Fertile Agricultural Lands of the Southeastern Section of the Commonwealth



The Town of Trout Run in Lycoming County in the Northern and Central Section of the Commonwealth. Most of the Forest Areas and a Major Portion of the Lumber Industry are Located in this Section

The production of oil and gas is still an important industry of the western area, but the State production of seven million barrels in 1920 was only 2 per cent of the total for the United States and was a decided drop from the peak of 32 million barrels recorded in 1891. In the refining of oil Pennsylvania takes higher rank than in the product of its wells, the output of its refineries running to 6 per cent of the total for the United States. Natural gas production, in 1917 approximately 130 billion cubic feet, had decreased by 1921 to 75 billion cubic feet.

In respect to the number of persons engaged in Pennsylvania, agriculture ranks below mining, there being in agricultural and dairying pursuits

in 1920 fewer than 10 per cent of all persons engaged in gainful occupations. However, there are more than 200,000 farms, or about 3 per cent of the total in the United States; and the agricultural industry is secure in its future. Of the future of the allied forest industry there is not the same assurance. Lumbering at one time was of major importance in the Commonwealth and Pennsylvania stood first in production among all the States, but between 1900 and 1921, the annual production fell off from 2,250,000,000 to about 500,000,000 board feet, and the industry is now at a low ebb from which it will return only as the benefits of the present program of reforestation are realized.

AMOUNT AND CHARACTER OF PRESENT HIGHWAY TRAFFIC

The tremendous increase in motor traffic during recent years has relegated the horse-drawn vehicle to a place of relative insignificance upon such principal roads as are included in the State highway system. Although the number of horse-drawn vehicles was recorded during the survey, they were found to be so few as to justify no further statistical analysis. The real problems relating to highway development at the present time are those resulting from motor vehicle traffic; and for this reason the following discussion is limited to motor vehicles only.

The average daily motor vehicle travel¹ on the State highway system during 1924 was found to be approximately 6,526,000 vehicle miles. Between 1924 and 1927 it is estimated that traffic has increased approximately 40 per cent and the daily use of the highways in 1927 is therefore approximately 9,135,000 vehicle-miles.

It is impossible to determine accurately the actual number of vehicles daily using the state highway system but it is estimated that the number of passenger car trips made daily in 1924 was approximately 350,000 and in 1927 approximately 490,000.

Amount of Traffic on Primary and Secondary Parts of the State Highway System.—About 64

per cent of the traffic on the State highway system was carried by the primary system in 1924. At that time the average daily density of traffic on the primary system was 1,051 and on the secondary system 375. In 1927 it is estimated that the average daily density of motor vehicle traffic on the primary system was nearly 1,500 and on the secondary system over 500.

Traffic on Improved Versus Unimproved State Highways.—At the time the traffic survey was made, in 1924, approximately 58 per cent of all the State highways were improved with hard-surface pavements. The average traffic density of the improved sections of the primary system was 1,210 vehicles per day, whereas the unimproved highways carried only 348 vehicles per day. On the secondary system the improved sections carried an average of 593 vehicles daily, and the unimproved an average of 210.

Traffic on State Highway System in Relation to Total Highway Traffic.—The total motor vehicle utilization of the rural highways in 1924 was approximately 3,487,210,000 vehicle-miles.

The traffic on the State highway system, which comprised about 11 per cent of the rural highway mileage, amounted to 6,526,000 vehicle-miles daily, or 2,381,990,000 vehicle-miles annually, which was 68.3 per cent of the total vehicle-mileage on the entire rural highway system comprising 93,194

¹ The traffic counts and information in the report, except as otherwise stated, are as of 1924.

miles. The remaining 1,105,220,000 vehicle-miles or 31.7 per cent of the total on the rural highways were on the State-aid, county, and township roads which constituted 89 per cent of the total rural highway mileage.

Of the 3,487,210,000 vehicle-miles on the rural highways, 1,516,575,000 or 43.5 per cent of the total was on the 3,953 miles of primary or main highways of the State highway system, which constitute only 4.2 per cent of the mileage of rural highways. On the 6,321 miles which constituted the secondary highways of the State highway system in 1924, and which was 6.8 per cent of the total rural highway mileage, the traffic amounted to 865,415,000 vehicle-miles, or 24.8 per cent of the total on all rural highways.

The amount of vehicular traffic on the rural highways probably increased about 40 per cent between 1924 and 1927, or from 3,487,210,000 to about 4,900,000,000 vehicle-miles annually.

Variations in Traffic Density on the State Highway System.—There is a wide variation in the amount of traffic on different parts of the State highway system and a very marked variation between routes and even different sections of the same route. In general, traffic density varies with population density and practically all of the routes carrying heavy traffic are adjacent to or connect the large cities.

The eastern section, which is the area of densest population and greatest industrial development is also the region of greatest traffic concentration; the western section is next in importance and the northern and central section is of least traffic importance. The region of maximum traffic concentration is around the City of Philadelphia.

Relative Traffic in the Three Geographical Sections.—The average density of traffic on the State highway system in the eastern section in 1924 was 1,039 vehicles per day, approximately the same as the average density of traffic on all roads in the primary system. The average of 658 vehicles for the State highway routes in the western section was approximately equal to the average traffic on the entire State highway system; and the average of 348 vehicles per day in the northern and central section was approximately the

same as the average recorded traffic on the secondary routes of the State highway system.

In 1924, 890 miles or 8.7 per cent of the 10,274 miles of State highways were carrying over 1,500 vehicles per day and 2,202 miles, 21.4 per cent, were carrying from 600 to 1,500 vehicles daily, while 7,182 miles or 69.9 per cent were carrying less than 600 vehicles per day.

The eastern section contained only 27.1 per cent of the State highway system, but 72.8 per cent of all the mileage of State highways carrying over 2,000 vehicles per day in 1924 were in this area, as were 72.4 per cent of those carrying over 1,500 vehicles per day.

The western section had 32.2 per cent of the State highway mileage in 1924 and 25.0 per cent of the mileage carrying over 2,000 vehicles and 25.1 per cent of the mileage carrying over 1,500 vehicles per day.

Traffic in the northern and central section was found to be smaller than in either of the other sections. Although this section contained 4,181 miles of State highways, 40.7 per cent of the total, only 9 miles in 1924 carried a daily average of more than 2,000 vehicles (only 23 miles carried over 1,500 vehicles, and there were only 690 miles which carried over 600 vehicles daily).

Concentration of Traffic Near Centers of Population.—Practically all routes carrying heavy traffic are adjacent to or connect the large cities.

Of the 644 miles of highway in the eastern section carrying an average of over 1,500 vehicles daily in 1924, 169 are in the Philadelphia district, 142 connect and radiate from the cities of Reading, Allentown and Easton, 79 radiate from Harrisburg, 88 are in the Scranton-Wilkes-Barre district, and 89 in the Sunbury, Shamokin, and Pottsville district.

In the western section 66 miles, carrying an average of over 1,500 vehicles daily in 1924, radiate from Pittsburgh and 37 miles form the interstate route from New York to Ohio through Erie.

Maximum Traffic in Philadelphia Region.—In Bucks, Chester, Delaware and Montgomery counties, forming an approximate semi-circle of 36 miles radius drawn about the City of Philadel-

phia and including less than one-twentieth of the area of the Commonwealth, the traffic on the State highway system in 1924 was approximately one-sixth of the traffic on the entire State system. A large part of this traffic, particularly in Bucks and Chester counties which have a relatively low density of population compared with Delaware and Montgomery counties, originates in the City of Philadelphia. Traffic on the State highway system in these four counties was approximately equal to the traffic in 22 northern counties which comprise 36.6 per cent of the State area. In explanation, it may be remarked that the population of these four counties and of the City of Philadelphia in 1920 was about 28 per cent of the State total, whereas the 22 northern counties had only about 9 per cent of the total.

Traffic Variation Between Individual Routes.—There is a very marked variation of traffic on various routes. At the Philadelphia city line on the route to Media the average motor traffic per day was 9,114 vehicles, while on Route 289 of the secondary system in Lycoming county, the daily average was but 22 vehicles. The maximum daily traffic at these two stations was 25,060 and 80 vehicles, respectively.

Comparison of important through routes indicates large variations in traffic volume. On the Lincoln Highway from the New Jersey line through Philadelphia to Pittsburgh, including approximately 290 miles of State highway, the average density of traffic in 1924 was approximately 1,800 vehicles per day. *The population*

of an area ten miles wide on each side of this highway is about 4,000,000. In sharp contrast with this the average traffic on 371 miles of the Roosevelt Highway in the northern part of the Commonwealth was only about 500 vehicles daily, and it is pertinent to remark that the population of a similar belt 10 miles wide on each side of this highway is only about 600,000.

Variation on Sections of Main Routes.—There is also a wide variation in the amount of traffic on different sections of the main routes and the rapid decrease in traffic with distance from the centers of population indicates that even on the "through routes" the major part of the traffic is local in character. On the 88 miles of the Lincoln Highway from Chambersburg to Jennerstown the average density of traffic was 800 per day, whereas it was 3,940 per day on the 35 miles from Philadelphia to Coatesville, and 2,699 per day on the 23 miles from Greensburg to Pittsburgh. On the northern section of the Lackawanna Trail, from Great Bend to Kingsley, the traffic was 692 vehicles per day as compared with 4,626 per day on the 6 miles from Willow Grove to Philadelphia, and 3,002 vehicles per day on the 11 miles from Factoryville to Scranton.

Seasonal, Monthly and Daily Variations in Traffic.—The traffic densities discussed above are those of an average 24-hour day throughout the year. On individual days in different seasons of the year, the traffic will, of course, vary widely from these averages, as shown on typical routes listed below.

Route	Location	Total daily traffic in numbers of vehicles			
		Average day-year period	Average day-winter (Nov.-Apr.)	Average day-summer (May-Oct.)	Average day-maximum month
Lincoln Highway	Philadelphia—Coatesville	3,940	2,760	5,120	6,460
Susquehanna Trail	Lawrenceville—Trout Run	729	440	1,060	1,390
Lackawanna Trail	Clarks Ferry—Harrisburg	2,483	1,550	3,420	4,070
	Great Bend—Kingsley .	692	310	1,070	1,310
	Willow Grove—Philadelphia	4,626	3,350	5,900	7,590
Roosevelt Highway	Wellsboro—Coudersport	341	220	460	650

The seasonal maximum of passenger car traffic in Pennsylvania is reached in August, when the traffic is 70 per cent greater than the monthly average.

The month of maximum truck traffic is October, but the seasonal variation is not as wide as that of passenger car traffic, by reason of the offsetting effects of climate and business peak. In the southern counties the seasonal maximum is only about 25 per cent above the monthly average but in the north the excess is about 50 per cent.

Sunday passenger car traffic for the Commonwealth as a whole is 85 per cent greater than the average for the seven days of the week; but Sunday truck traffic is only 17 per cent of the seven-day average.

The hour of maximum traffic occurs during the afternoon hours, but varies on different routes, and at different seasons of the year. During the summer months the maximum hour is generally between 4 p. m. and 8 p. m., during the winter months between 4 p. m. and 6 p. m. The traffic density during the maximum hour approximates twice the density of the average hour of the day.

Combining the seasonal and daily averages in traffic, it appears that maximum passenger car traffic, that is, traffic on a Sunday in August, is about 270 per cent more than the average daily traffic for the year in the northern counties and approximately 170 per cent more in the south.

Amount and Character of Truck Traffic.—Truck traffic on the State highway system amounts to about 9 per cent of the total traffic, but this percentage varies from 4 to 18 per cent on different sections of highways, the higher percentages occurring on routes located in important industrial or mining areas. Of the total number of trucks observed, 62.7 per cent were loaded and 37.3 per cent were empty, the loaded trucks varying from 45 to 90 per cent at different stations.

Truck traffic over the State highway system as a whole is made up predominately of small-capacity trucks carrying light gross loads. Appreciable numbers of heavy trucks or loaded 5 to 7½-ton capacity trucks having gross weights exceeding 21,000 pounds are confined to relatively few localities. The distribution of total truck

traffic and of large-capacity truck traffic on the primary State highways is shown in Figure 8.

The total commodities transported over the 10,274 miles of State highways in 1924 was between 5,000,000 and 6,000,000 net tons. In the same year there were transported on the 13,428 miles of railroads in the Commonwealth more than 350,000,000 net tons of freight, of which nearly 9,000,000, net tons were L.C.L. (less than carload lots) shipments.² The freight haulage on the State highway system in 1924 was 148,000,000 net ton-miles, while the L.C.L. railroad shipments amounted to about 400,000,000 ton-miles.

Products of manufacture comprised 60 per cent of the total net tonnage on the highways. The remaining 40 per cent was made up of products of mines, 13 per cent; products of animals, 11 per cent; products of agriculture, 9 per cent; and of forests, 7 per cent.

The total truck traffic on the State highway system in 1924 amounted to 214,255,000 truck-miles, representing an average daily traffic of 587,000 truck-miles, of which 369,000 were on the primary system and 218,000 on the secondary system. By 1927 it is estimated that the truck traffic on the State highway system has increased about 40 per cent over that recorded in 1924, or to about 300,000,000 truck-miles annually, representing a daily truck travel of about 800,000 truck-miles.

The average daily density of truck traffic on the entire State highway system in 1924 was 57, on the primary system 93, and on the secondary system 35.

A wide variation was found in 1924 between the number of trucks operating on the different State routes. The average daily density of truck traffic was 233 on 661 miles of the most heavily traveled roads of the primary system around the principal centers of population, and only 38 on 1,436 miles of primary roads, in the light traffic areas. The remaining 1,856 miles of medium traveled primary roads carried a density of 86 trucks per day.

On the individual routes around the principal

² Estimated by the Pennsylvania Department of Highways from the reports to the Pennsylvania Department of Internal Affairs.

centers of population truck traffic exceeded 600 vehicles per day, and in 1927 it is estimated that the average truck traffic on certain of the main routes close to the City of Philadelphia amounts to as high as 900 trucks per day.

The City of Philadelphia was found to be the most important trucking center, particularly from the standpoint of heavy loads, with Pittsburgh next in importance.

Weight of Trucks.—The average gross weight of all loaded trucks weighed in 1924 was 7,600 pounds. Of the total number, 56.6 per cent weighed less than 6,000 pounds, only 8.7 per cent weighed 18,000 pounds or over; and only 2.4 per cent had gross weights of 24,000 pounds or over.

The average net and gross weight of loaded trucks, and the average weight of empty trucks by capacity groups is shown in Table 2.

Trucks of small capacity (rated capacity of $\frac{1}{2}$ to $2\frac{1}{2}$ tons) are found on all sections of the State highway system although in varying numbers. Large-capacity trucks do not operate to any great extent on all State highways or sections of highways because of the absence of need for the service for which they are economically fitted. There must be a sufficient total volume of tonnage or some group of commodities ready for movement over the highways in a given area before any noticeable number of large-capacity trucks operate. The larger the movement of all trucks in any given area the greater is the probability of a considerable number of large-capacity trucks and heavy loads. The use of all trucks in respect to number and size depends upon the amount and type of commodities to be hauled and

consequently upon the population and industries of the area served.

Trucks Operated for Hire.—Of the total truck traffic on the State highway system, 13.8 is made up of trucks operating for hire either on a contract or tariff basis. As between contract and tariff haulage, the former is of considerably greater importance in terms of tonnage transported.

An examination of the records of the Public Service Commission shows that in 1926 there were about 309 concerns holding certificates of public convenience for freight hauling on a tariff basis. About 162 of these concerns operated over the State highway system, about 50 on routes radiating from Philadelphia. These routes average 17.5 miles between termini and cover about 2,000 miles of State highways.

One railroad company has contracts with several trucking companies for the distribution of package freight between way stations.

Heavy Loads Confined to Few Localities.—The primary and secondary State highway systems, with few exceptions, include all the highways which carry any considerable number of large-capacity trucks. But even upon the State system the movement of large-capacity trucks is important on only a relatively small part of the system. Reference to Figure 8 shows that there is a marked concentration in the volume of total truck traffic and of loaded 5 to $7\frac{1}{2}$ -ton trucks around the important centers of population and industry, particularly in the eastern section, whereas the truck traffic is very light in the northern and

Table 2—Average weights of motor trucks by capacity classes

Motor truck capacity	Classified as	Net	Average weight	
			Gross	Empty
Tons		Pounds	Pounds	Pounds
$\frac{1}{2}$ — $1\frac{1}{2}$ }	Small capacity	1,050	4,160	3,110
2— $2\frac{1}{2}$ }		3,410	10,270	6,860
3—4	Medium capacity	5,790	15,450	9,660
5— $7\frac{1}{2}$	Large capacity	8,420	20,620	12,200

central section, because of the small population and the mountainous terrain.

Heaviest Truck Traffic in Philadelphia Region.—The most important motor trucking area is the territory around the City of Philadelphia. Two routes radiating from Philadelphia were found to carry approximately 600 trucks per day, on one of which 190, or over 30 per cent, were 3 to 7½-ton capacity trucks, and 81, or nearly 15 per cent, were loaded 5 to 7½-ton trucks. These large-capacity trucks constitute the most important consideration in truck traffic.

On the assumption that the truck traffic increased 40 per cent between 1924 and 1927, the average number of trucks in 1927 is approximately 850 per day on the highways between Philadelphia and Paoli and between Philadelphia and Chester.

Interstate Truck Traffic.—Truck travel on certain of these highways, particularly on the Lincoln Highway from Philadelphia to Trenton and New York, is partially an interstate movement. Of the total trucks moving into or out of Philadelphia on this route, 66 per cent originated at or were destined to New Jersey and New York points, and the external influence is particularly pronounced in the case of the trucks of the larger capacities. The truck traffic on no other route is influenced to as great an extent by outside cities, although a considerable part of the traffic on the Philadelphia-Chester-Wilmington route was also found to be interstate. The only other routes where truck traffic was affected to any

appreciable extent by foreign State influences were the routes into Erie from Buffalo on the east and Ashtabula and Cleveland on the west; the route into Beaver Falls from Youngstown, Ohio, and the route into Uniontown from Morgantown, West Virginia.

Pittsburgh Second Important Truck Center.—The City of Pittsburgh is the center of the second most important trucking area. There are three main trucking routes on the State highway system: the first from Pittsburgh northeast to Tarentum; the second, the Lincoln Highway southeast to Greensburg; and the third, the route from Pittsburgh southwest to Bridgeville. Several county roads radiating out of Pittsburgh also carry considerable truck traffic, that on the east side of the Ohio River toward Beaver carrying 274 total trucks per day in 1924 of which 20 were loaded 5 to 7½-ton trucks. The highway to Tarentum had the heaviest truck traffic in 1924—457 trucks per day with 26 loaded 5 to 7½-ton trucks.

Based on the assumption that the traffic has increased 40 per cent between 1924 and 1927 the average truck traffic in 1927 on the highway between Pittsburgh and Tarentum is about 640 trucks per day, and on the other two important trucking routes mentioned is between 500 and 600 trucks per day.

The City of Pittsburgh is, of course, the dominating influence upon motor truck traffic in this section, as evidenced by the fact that 87 per cent of the trucks on the route to Tarentum were either coming from or going to Pittsburgh.

Table 3—Average daily density of total truck traffic by capacity classes, and traffic of loaded 5 to 7½-ton trucks on the principal primary State highways out of Philadelphia in 1924

Route from Philadelphia		Daily total truck traffic			Daily traffic of loaded 5 to 7½ ton trucks
No.	To	All trucks	½ to 2½ ton trucks	3 to 7½ ton trucks	
142	Paoli	605	452	153	55
180	Chester	600	410	190	81
281	Trenton	336	195	141	66
151	Willow Grove	329	262	67	23
130	Media	301	224	77	17

There are three minor areas in the western section which warrant mention from the standpoint of motor truck traffic. These are in the vicinity of Beaver, Uniontown and Altoona, but the zone of heavy motor traffic in each area is comparatively short.

Scranton-Wilkes-Barre — The Third Area.—The third important area of motor truck traffic in 1924 was found to be adjacent to the cities of Scranton and Wilkes-Barre in the anthracite producing region. There are two important trucking routes in this area, one from Wilkes-Barre to Scranton on the east side of the Susquehanna River and thence to Carbondale. Motor truck density on this route was greatest just west of Scranton where the average daily number of all trucks was 626 per day, of which 73, or about 12 per cent, were 3 to 7½-ton trucks, and 13, or 2 per cent, were loaded 5 to 7½-ton trucks. Between Scranton and Carbondale there was a total truck movement of about 364 per day of which about 10 per cent were of 3 to 7½-ton capacity. The second route—on the west bank of the Susquehanna River from Pittston to Wilkes-Barre and beyond—averaged 378 trucks, between Pittston and Wilkes-Barre and 390 south of Wilkes-Barre. The motor truck movement in this area is almost entirely a local short-haul movement, averaging between 13 and 18 miles.

Reading, Harrisburg, and Other Cities.—Reading and Harrisburg are the centers of the next most important areas of motor truck concentration. Reading is the hub of motor highways leading to Allentown, Pottsville, Harrisburg and Philadelphia. Traffic on important routes out of Harrisburg, with the exception of the route to Lancaster, is predominantly a local movement, and at least half of the trucks travel less than ten miles per trip.

The cities of Pottsville and Shamokin are the centers of population and industry in another important area of motor truck concentration, while the cities of Allentown and Bethlehem also form the center of such an area. The remaining

areas surround York and Lancaster. The least important of these areas surrounds Lancaster which is the center of an agricultural rather than an industrial region.

East of Erie there was an average truck density in 1924 of 180, 10 of which were 3 to 7½-ton trucks, while west of Erie the density was 129, of which 10 per cent were large-capacity trucks.

Northern and Central Section.—Motor truck traffic on the highways in the northern and central section is very small and in practically all cases in 1924 consisted of less than forty vehicles per day, and these trucks were generally small in capacity and for the most part equipped with pneumatic tires. Highway improvement designed to serve heavy motor truck traffic will be generally unnecessary in this section for a considerable number of years.

Amount and Character of Motor Bus Traffic.—The total registration of motor vehicles engaged in carrying passengers for hire in 1924 was 6,773. In 1926 the total registration of these vehicles was 8,034^a of which approximately 70 per cent had a seating capacity of 8 persons or less. These smaller vehicles are similar to the passenger automobile in size, weight and equipment and do not constitute a separate highway problem. An analysis of the seating capacity of 2,252 motor busses having a seating capacity of more than 8 persons is shown in Table 4.

Table 4—Motor busses with seating capacity in excess of 8 persons, 1926

Seating capacity	Number	Per cent	Estimated maximum gross weight
			Pounds
9—26	1,696	75.3	13,000
26—40	364	16.2	18,000
41—63	12	0.5	26,000
64	6	0.3	26,000
67	174	7.7	26,000
Total	2,252	100.0	

Of the total of 2,252 busses, about 25 per cent were operated exclusively in cities, there being nearly 500 in Philadelphia, 50 in Pittsburgh and

^a Of this total, 474 were operated by school districts or were engaged in interstate traffic, and no certificate was required from the (Pa.) Public Service Commission.

a smaller number in Scranton and several other municipalities. The 180 busses of 64 or 67 seating capacity are double-deck busses operated in Philadelphia. There are also about 100 busses operated out of the larger cities, especially Philadelphia, to adjoining States.

About 1,500 busses are operating on the rural highways. It has been estimated that nearly 400 are engaged in carrying school children in consolidated school districts. It has also been estimated that about 900 busses are being operated on the State highway system. The total seating capacity of the busses operating on the State highway system is approximately 17,000, or an average of 19 seats per bus. The routes as described in the applications for certificates of public convenience cover about 2,800 miles of the State highway system, or less than 25 per cent of the total mileage of the system. The average length of the routes on State highways, for which certificates have been issued is 12.4 miles between termini. In Figure 2 are shown the bus routes on the State highway system. There are only two of the 67 counties which do not include bus routes. Those which have the highest mileage and accordingly the most pronounced development of bus traffic on the State highway system are all western counties, Butler, Mercer, Washington, Westmoreland, Indiana, Somerset and Fayette. The mileage is also pronounced in the case of Bradford and Tioga Counties, in the northern tier, and Chester County, adjacent to Philadelphia.

Foreign and State traffic.—Of the total passenger car traffic on the principal routes of the primary State highway system in 1924, 86 per cent was made up of cars registered in Pennsylvania, and 14 per cent of cars which carried license tags from other States.

The utilization of the principal traffic routes of the primary States highways by motor trucks of foreign registration was less than by passenger cars of foreign registration, amounting to only 4.4 per cent of the daily truck-miles. Traffic by trucks of foreign registration is of little significance except in border counties, and within these is important only on the principal interstate highways.

Touring and Non-Touring Traffic.—Touring trips are defined as trips of more than one day's duration, taken principally for recreation. Of the total passenger car traffic on the principal routes of the primary system 5.6 per cent is made up of cars on touring trips, largely limited to important through routes. The highest proportion of touring to total traffic was found on the light-traffic sections of important through routes, such as the section of the Lincoln Highway between McConnellsburg and Bedford, and the National Pike between Summit and the Maryland line. The volume of touring traffic is equally large on other sections of important through routes but it forms a smaller part of the total because of the greater volume of local traffic.

Business and Non-Business Use.—Of the total passenger car traffic on the principal routes of the primary system, 52.8 per cent was made up of cars on business trips, and 47.2 per cent of cars on non-business or pleasure trips. Business and non-business traffic is quite equally distributed over the primary system. Business traffic is of greater importance on the routes adjacent to the larger cities and in the industrial areas. Non-business traffic is of greater importance on the important through routes, scenic routes and in areas adjacent to pleasure resorts and to places of historic interest.

City-owned and Farm-owned Cars.—Passenger car traffic on the primary system, in 1924 was predominantly a traffic of city-owned cars, making up 92.9 per cent of the total daily passenger-car-miles. The term *city owned* includes all cars not actually owned on farms. Farm-owned cars made up 7.1 per cent of the total daily passenger-car-miles. This low percentage indicates that the movement of farm-owned cars is primarily a local movement. It applies, however, only to the principal routes of the primary system, and on other highways it is probably that the proportion of farm-owned cars exceeds the proportion found on the primary system.

Number of Passengers per Car.—The average number of passengers per car under all types of car usage was found to be 2.6 persons. Cars registered in Pennsylvania averaged slightly less

than this figure, and cars registered in other States averaged 2.8 passengers per car. Cars on touring trips averaged 3.2 persons per car; cars on business trips two persons; and on non-business or pleasure trips 3.3 persons per car.

Total Passenger Mileage.—Total passenger-car mileage on the State highway system in 1924 was

approximately 2,167,000,000 and the passenger-mileage was about 5,500,000,000. The railroads in the same year carried about 135,000,000 passengers in the Commonwealth for a total of 4,300,000,000 passenger-miles.⁴

⁴ Estimated by Pennsylvania Department of Highways from the reports to the Pennsylvania Department of Internal Affairs.

FORECAST OF FUTURE HIGHWAY TRAFFIC

Motor Vehicle Registration and Traffic Increase Equally.—Highway traffic and motor vehicle registration have increased at nearly equal rates over a relatively long period in all other States for which traffic information is available despite differences in industrial development, wealth and population. It may, therefore, be assumed that what is true of these States will also be true in Pennsylvania; namely, that registration and traffic will increase at approximately equal rates and that the percentage of increase predicted for motor vehicle registration for the next few years can be used for forecasting future traffic.

This prediction, however, is based on the assumption that the average mileage per vehicle per year will show no important change for a period of five or six years in the future.

Estimated Increase in Future Traffic.—The prediction of motor vehicle registration for 1925 agreed very closely with actual registration for that year. For 1930 the number of registered motor vehicles is estimated at 2,086,000, an increase of about 70 per cent over the 1924 registration. Applying the principle that the rate of traffic increase is equivalent to the rate of increase in motor vehicle registration, it was accordingly estimated that the traffic for the Commonwealth as a whole would increase about 70 per cent between 1924 and 1930.

Applying forecasting to County Units and Individual Routes.—The same basis of forecasting was applied to county units so as to eliminate differences in the ratio of the persons per registered vehicle in the different counties. The forecasts of county increases in traffic were then applied to the traffic on sections of highway adjacent to each traffic station.

There is a wide variation in the estimated increase in traffic in the several counties, ranging from an 11 per cent increase between 1924 and 1930 for one of the northern counties, which has a rapidly decreasing population, to 85 per cent in Delaware County, which during the past decade had the highest population increase among the several counties.

Effect of Estimated Future Traffic on the Highway Program.—The analysis of future traffic density is important, both from the standpoint of location of routes on the highway system and the determination of the extent of the improvement necessary. To serve its purpose completely, a highway must be able to accommodate those vehicles which will normally be operated upon it.

With respect to passenger car traffic, the number of cars is the only information needed. The average daily traffic is of less significance than the maximum hourly traffic on routes of extremely large density. The type of car is of no great significance from the standpoint of designing the pavement to carry the load, since passenger cars average only about 2,800 pounds (including the weight of passengers) and the minimum and maximum weights range from approximately 1,800 to 6,500 pounds. Weights over 5,000 pounds are infrequent. Moreover, practically all passenger cars are equipped with pneumatic tires and various kinds of shock absorbers.

With respect to the motor trucks, on the other hand, the range in capacity and weight is a very important consideration in the planning of highway improvements. The smallest trucks ($\frac{1}{2}$ -ton capacity) observed on the State highway system had an average gross weight of 2,490 pounds,

while the largest (those of 7½-ton capacity) averaged practically 24,000 pounds gross weight. It can readily be seen that different types of highways must be planned for light and heavy truck loads, as well as for the volume of total traffic. The highway built to carry only passenger car traffic and small, light trucks will not stand up under heavy traffic of large-capacity trucks. However, it is not an economically sound policy to build highway improvements capable of carrying heavy truck loads where there are not enough heavy trucks using the highway nor any occasion for, or likelihood of heavy trucking during the life of the pavement.

The analysis of bus traffic presented in previous pages indicates that only 9 per cent of the busses with seating capacity of 9 persons or more operating on September 1, 1926, had a total loaded gross weight above 18,000 pounds, which would be comparable with the heavy truck classification or large-capacity trucks carrying 5 to 7½ tons load. Practically all of the busses in this 9 per cent group were equipped with solid tires and nearly all of them were operated in the cities. Of particular importance with regard to these large-capacity busses is the fact that many of them are designed for the full 8-foot width permitted by law. This fact is of considerable importance when there is any appreciable amount of bus traffic, and under such conditions has a determining effect upon the width of the road surface. Bus traffic also raises an additional consideration, in that frequent stops on the ordinary two-lane road slows up traffic. A considerable amount of bus traffic on an important route would therefore require turn-outs upon which to make bus stops, and eventually it would probably require widening of the roadway.

Proposed Classification of Highways.—The relationship between traffic demand and extent of improvement required on the various State highways can perhaps best be visualized by classifying the various highways into groups according to the amount and character of the traffic. To each such class can then be assigned the strength and width of pavement most economical in relation to the passenger car and motor truck traffic of the class.

These classes have been designated in order of traffic importance as terminal, industrial and semi-industrial.

The classification of individual routes is made on the basis of the volume of total traffic, the total number of trucks, the number of 3 to 4-ton trucks and the number of trucks of larger capacity (5 to 7½-ton).

Terminal Highways.—The terminal highway is rated as one carrying a considerable number of heavy (5 to 7½-ton) trucks. A considerable number of the loaded, large-capacity trucks on the terminal highway indicates the need for a pavement designed to carry extra heavy loads.

Industrial Highways.—The industrial highway is rated as one which carries a large amount of truck traffic but relatively fewer of the 5 to 7½-ton loaded trucks than the terminal highway. In this class, pavements should be designed to carry heavy loads and extra heavy loads in limited numbers.

Semi-Industrial Highways.—The semi-industrial highways are primarily passenger car routes on which very little trucking of over 2½-ton trucks is expected. On these highways, pavements need not be designed to carry frequent heavy loads.

Classification of Highways on the Primary or Main Highway Routes.—Main highways should be designed to carry traffic desiring to use them and the strength of construction necessary depends on the load limit and the frequency of heavy loads which the pavement is required to carry. In constructing pavements on the through routes of the State highway system, provision should be made for the accommodation of vehicles loaded to the full legal limit and for such frequency of heavy loads as is proved to be probable on each section of the through route. It is realized that there are many sections of such through highways upon which pavements suitable for heavy truck traffic will not be needed for some time. However, a study has been made of all sections of the main highways classified as terminal and industrial with the purpose of indicating when, on the basis of the estimated future traffic, these sections will have to be provided with pave-

ments adequate for terminal and industrial truck traffic, as outlined above. This information will be of value to the Department in estimating the future highway replacement program.

The Lincoln Highway from Trenton, New Jersey, through Philadelphia, Lancaster, York, Bedford, Greensburg, Pittsburgh and thence on to the West Virginia line near East Liverpool, Ohio, is the heaviest traffic through route and there always will be some heavy truck loads (of 21,000 pounds or over, gross weight) crossing the Commonwealth on this highway. Because of its importance as a main highway, it is classed as semi-industrial or industrial throughout its length, except short sections near Philadelphia and Pittsburgh which are classed as terminal. However, there are sections of this highway, such as the section from Chambersburg to Jennerstown, that are carrying today very few truck loads of 21,000 pounds or over. By reason of its location and distance from large centers of population, it is estimated that on this particular section of the percentage of heavy truck loads will not materially increase for a great many years. It would not, however, be practicable to exclude industrial traffic from this section of through highway, and there are similar instances on all of the through highways.

On the basis of the observed traffic, the following classification has been established for terminal, industrial, and semi-industrial highways on the primary system:

Location of Terminal Highways in 1924.—The 122 miles of terminal highways in 1924 are located, except for one mile west of Harrisburg, in three small areas; the Philadelphia, Pittsburgh, and Scranton-Wilkes-Barre areas. Seventy-one miles of primary highways terminating in Phila-

delphia are classified as terminal in 1924. These highways connect Philadelphia with Trenton, Chester and the Delaware line, Media, Coatesville and Willow Grove.

Second in importance to the Philadelphia area is that surrounding Pittsburgh, where 26 miles of highway on the primary system, connecting Pittsburgh with Bridgeville, Springdale and East Pittsburgh are classified as terminal in 1924; and finally, there are 24 miles classified as terminal in the Scranton-Wilkes-Barre region.

Future Changes in Classification.—For the Commonwealth as a whole, the terminal highway mileage more than doubles between 1924 and 1930 and is nearly three times as great in 1935 as in 1924. Highways classified as industrial in 1930 will slightly more than double the mileage of 1924, and by 1935 the industrial class is more than 2½ times as great as in 1924. Semi-industrial highways in 1930 have only two-thirds of the 1924 mileage, and in 1935 there is a further reduction to only about half of the 1924 mileage.

Location of Terminal Highways in 1935.—In the Philadelphia area, which has about 60 per cent of the terminal highway mileage in 1924, the increase by 1935 is small in the latter year, 79 of the 336 miles of predicted terminal highways are in this area. Terminal highways in the Reading, Allentown, Bethlehem, Easton and Pottsville area will comprise 104 miles in 1935, but Philadelphia will continue to be the most important single city on the basis of heavy truck traffic, which is the important factor in classifying a road as a terminal highway. The mileage of State highways of Pennsylvania radiating from Philadelphia also constitutes only a part of the highways leading out of Philadelphia as a metropolitan center, since no account has been taken of the traffic which

Terminal			Industrial		Semi-Industrial		Total	
Year	Miles	Per cent	Miles	Per cent	Miles	Per cent	Miles	Per cent
1924	122	3.09	812	20.54	3,019	76.37	3,953	100.0
1930	279	7.06	1,641	41.51	2,033	51.43	3,953	100.0
1935	336	8.50	2,084	52.72	1,533	38.78	3,953	100.0

goes across the river and thence through Camden, New Jersey.

At present there is freer traffic intercourse between Philadelphia and Camden as a result of the building of the Philadelphia-Camden bridge, which was opened to traffic on July 1, 1926. The exact effect of this bridge upon the traffic in the Philadelphia region is somewhat problematical. It will probably tend to draw passenger car traffic into Philadelphia and thence over the bridge to New Jersey that formerly may have by-passed the Philadelphia region to cross the river at points outside of the city, but it will probably not have much effect upon truck traffic now using State highways since the latter is a short-haul movement.

In 1935 the Scranton-Wilkes-Barre area will have 67 miles of terminal highway, and adjacent to Harrisburg there will be 30 miles. The mileage of terminal classification on the State routes leading into Pittsburgh will not increase by 1935, although the Pittsburgh region will continue to be of great importance from the standpoint of truck traffic. The Pittsburgh region is more self-contained than some of the other populous centers, and because of the generally mountainous terrain it is not probable that truck traffic sufficient to justify classification as terminal routes will develop within the next few years on those routes or sections of routes which are not already terminal in character.

Distribution by the Three Geographical Sections.—In 1924 the eastern section contains more than three-fourths of the terminal mileage and nearly three-fourths of the industrial mileage. The terminal mileage in this section increases in importance both in 1930 and 1935. The industrial class mileage also increases, but less rapidly than in the western and northern and central sections. The proportion of industrial mileage in the eastern section decreases from 73 per cent in 1924 to 45 per cent in 1930 and to 35 per cent in 1935. In the western section, 83 per cent of the mileage is semi-industrial in 1924, and but 24 per cent of the mileage is in this class in 1935, indicating the rapid change from semi-industrial to industrial in this section during the next 10 years.

The 1924 classification of highways in the northern and central section shows that nearly 98 per cent of the total mileage is in the semi-industrial class. No mileage is classified as terminal in 1924 and but 6 miles, located adjacent to Lewistown, are in this class in 1930 and 1935. The greatest change in classification in this section will, therefore, be from the semi-industrial into the industrial class, the mileage of the latter increasing from 33 miles in 1924 to 444 in 1935.

Tentative Program of Highway Improvements.—Analysis of the 3,953 miles of the primary system, with consideration of the present condition of the surface, present traffic, and estimated future traffic, indicates the mileage of replacement and resurfacing that will probably be required provided the conditions and estimates of traffic upon which the proposed schedule is based do not materially change.

Replacement

	Miles
*Replacement less than 2 years	265
Replacement 2 to 5 years ..	406
Replacement 5 to 10 years ..	228
Total replacement within 10 years	899

* Replacement indicates rebuilding worn-out stone roads with a durable type of pavement.

Resurfacing

*Resurfacing less than 2 years	122
Resurfacing 2 to 5 years ..	135
Total resurfacing within 5 years	257

* Resurfacing indicates laying new surfaces of a flexible type and adding additional stone to bring the base to the proper thickness.

The whole program as thus outlined, involves about 30 per cent of the primary system mileage. During the 5-year period it includes 928 miles, or about 25 per cent of the primary system; and of these 928 miles, replacement will be required on over 70 per cent.

Distribution of Program by Geographical Sections.—The eastern section, as already shown, is the most important traffic area from the standpoint of both total traffic and motor trucking and contains a larger percentage of terminal and industrial highway mileage, than either of the two other sections, and it is logical that a considerable part of the highway replacement program should be planned for the primary system of this section. A considerable mileage of the eastern section has been improved in the past with flexible types of surface which, while sufficient for the traffic of the period, must now be replaced with more durable types of pavement.

For the western section a relatively small mileage of replacement is proposed for three reasons: First, because there is in this section at present a very small mileage of stone pavements compared with the eastern section; second, because an extensive program of construction of durable surfaces has been under way for some time in this section and these surfaces, which have been substantially completed, will be adequate for a number of years; and third, traffic is considerably lighter in the western than in the eastern section.

In the northern and central section a very small mileage is planned for replacement and resurfacing during the next five-year period. This section is third in traffic importance and the main traffic routes, as such, are at the present time largely new and durable pavements.

Parallel or Alternate Routes.—Additional traffic lanes increase the traffic-carrying capacity of a highway although probably not in direct proportion to the increase in width. Beyond a certain width it is inadvisable to attempt to carry additional traffic on the same route, and parallel routes must be provided. Additional routes will be necessary for purposes of entry into some of the cities in order to relieve congestion. This is true of Philadelphia, although Philadelphia is peculiarly fortunate in that few of the highways entering the city converge and combine in a single route. At Pittsburgh the situation is less satisfactory than at Philadelphia. Studies of parallel routes have been made by the Department in both of these regions.

Separate Trucking Routes.—The large volume of motor truck traffic in the Philadelphia region indicates that the development of separate highways for motor truck traffic may be necessary. The separation of truck traffic from passenger car traffic on State routes between Philadelphia and Trenton has already been considered with the probable removal of truck traffic from the Lincoln Highway, or northern route through Langhorne, and the segregation of truck traffic on the southern route through Bristol.

The development of a new terminal highway to take care of the large volume of truck traffic and the large number of heavy truck loads between Philadelphia and Chester along the Delaware River was made the subject of a special act of the General Assembly in 1923 and its location and design has been given some study. If built, it will mark the first state highway built primarily for heavy truck traffic.

The Department is now making studies to determine if a similar type of development will be required in the Pittsburgh area in the immediate future. It is doubtful whether a like necessity will exist elsewhere for a considerable period of years.

By-Pass Routes.—Traffic congestion in the centers of population can be relieved partly by routing through traffic over by-pass routes around the cities or boroughs; and at least, the situation can be considerably improved by routing traffic through these urban centers on the outlying streets rather than carrying it through the central business districts. Sentiment favorable to such planning is continually growing. Philadelphia needs a capacious "belt-line" upon which motor vehicles from Baltimore and other southern points on the way to Trenton and New York can avoid the congested streets of the city. The Department has recently made studies, in cooperation with the local authorities, of feasible by-pass routes, in both the Philadelphia and Pittsburgh areas.

Directness of Route.—It is important that the routes connecting the larger centers of population be not only of sufficient width and adequate type to carry a large volume of traffic, but also that

they be as direct as possible; accordingly all obstructions to the free and rapid movement of traffic, such as railroad grade crossings, sharp curves and heavy grades should be removed. Directness of route will require relocations which can be made as the highways are reconstructed for a greater volume of traffic. These relocations will require the acquisition of new right of way, which should be acquired in the immediate future, and rights of way for alternative and parallel routes should be acquired at the same time.

A classification of the 500 primary-system grade crossings on the basis of the number of train movements, amount of highway traffic, physical features of the location, etc., indicates that about 30 per cent are very dangerous, 30 per cent less dangerous and 40 per cent least dangerous. The percentage of very dangerous crossings is less on the secondary system.

Nearly 500 crossings have been eliminated by under-passes or overhead crossings on the State highway system. Many of these separations,



A Line Revision on Route 107 Near Julian in Centre County

Elimination of Dangerous Railroad Grade Crossings.—More than 1,200 grade crossings still exist on the State highway system. Their elimination is proceeding slowly and will require some years for accomplishment. During the years 1923-1926, the Department's program included the elimination of 251 grade crossings, 177 by relocation and 74 by under-pass or overhead construction.

Of the 1,200 grade crossings, about 500 are on the primary system and 700 on the secondary.

however, are considered dangerous to the highway traffic because of inadequate width, bad curves, etc., which require a reduction in speed for safety.

On some of the principal routes, there are relatively few dangerous crossings at grade. For example, on the Lincoln Highway from Philadelphia to Lancaster there are no dangerous, unseparated grade crossings, and this is also true of a few other routes.

Widening Beyond Two Traffic Lanes.—All primary-system roads provide at least two lanes

for traffic, and are surfaced at least 18 feet wide, while through the boroughs extra width has frequently been provided by the local residents. On a few sections of highway in the townships, the Department has already provided additional traffic lanes. On the Lincoln Highway west of Philadelphia the pavement has been widened to provide four traffic lanes, from Philadelphia through Ardmore, Bryn Mawr to Devon; and to accommodate three lanes of traffic from just west of Malvern to Downingtown. The route from Philadelphia to Chester is constructed to carry four lanes of highway traffic outside of the double-track central width now used by the interurban street railway company. A short section, 45 feet wide, is constructed adjacent to Pittsburgh on the route northeast to Freeport.

The two-lane highway can handle safely the maximum traffic on all except the extremely heavy traffic roads, but above a certain density, which varies with several factors such as types of vehicles, treatments of intersections, etc., the two-lane highway becomes unequal to its task with the result that traffic is retarded and congestion is increased.

Two traffic lanes will be adequate to carry the predicted volume of traffic on approximately 95 per cent of the mileage of the primary system for the next 5 to 10 years without congestion of traffic.

Around the cities of Philadelphia, Pittsburgh, Scranton and other important cities, there is need of greater capacity on many existing highways or the relief of congestion by the construction of parallel routes. The tentative plan of improvement includes the widening of 51 miles to greater than two-lane width in the next two years, about 64 additional miles in from two to five years, and approximately 35 miles immediately thereafter.

Value of the Service Produced by the State Highway System.—The large value of the service produced by the State highway system which, in 1924, carried over 2,000,000,000 passenger-car-miles and over 200,000,000 truck-miles of travel, is self-evident. Hard surfaced highways, replacing earth roads, have resulted in saving annually

large amounts in reduced motor vehicle operating costs.

An improved highway which is serviceable throughout the year has a value greatly in excess of an unimproved highway which is impassable during certain months of the year. The improved highway also saves time by permitting more rapid movement of traffic, and promotes the safety of the traveling public.

The foregoing items, comprising the service value of improved highways, relate primarily to the economic value. From the social and recreational standpoints, improved highways have additional values, which are universally recognized. Social contacts have been greatly facilitated. Educational facilities in the rural communities have been vastly improved, by the consolidation of schools made possible by surer means of transportation, and the improved highways have also greatly expanded facilities for recreation. Modern means of living are closely associated with motor transportation, the full development of which depends upon improved roads, and the many advantages of which are reflected in almost innumerable ways.

Saving in Motor Vehicle Operating costs by improved Highways.—The service value of the Pennsylvania State highway system, which carried in 1924 an annual traffic of 2,381,900,000 vehicle-miles, is very large, and is reflected in many ways. While it can not be exactly measured, it can be estimated with a reasonable degree of accuracy. The costs of operating the vehicles that compose the traffic are probably not less than 10 cents per vehicle-mile for passenger cars and 25 cents per vehicle-mile for trucks, and it is estimated by the Pennsylvania Department of Highways that the reduction in these costs made possible by the improvement of the highways is approximately 2.5 cents per passenger-car-mile and 5 cents per truck-mile.⁷

Applying these assumed savings of 2.5 cents per passenger-car-mile and 5 cents per truck-mile to the traffic on the 5,951 miles of improved highways in the State system, the annual service value

⁷ See Bulletin 69, Iowa State College of Agriculture and Mechanic Arts, Highway Transportation Costs, by T. R. Agg and H. S. Carter, page 20.

of these improved highways is found to be approximately \$9,100,000 for truck traffic and \$45,800,000 for passenger car traffic, a total of \$54,900,000, or an annual value of \$9,220 per mile of improved State highway.

The foregoing estimate is based on the observed traffic density of 1924. Converting to the basis of 1927 traffic density by the addition of 40 per cent, the estimated increase from 1924 to 1927, the saving to motor vehicle operators using the same 5,951 miles of improved highways of the State system is now approximately \$76,800,000 or an annual saving of \$12,900 per mile.

The Department of Highways considers this a conservative estimate of the value of the improvement that has been effected in the roads of the State highway system, as measured by savings in vehicular operating costs. If the more important highways of the system are singled out—those that carry the densest traffic—it can be shown in the same manner, that their service value greatly exceeds the average. Thus, the annual service value of the Lincoln Highway, U. S. 30, from Philadelphia to Pittsburgh was approximately \$4,701,000 in 1924, or approximately \$17,150 for each of its 274 miles. Similarly, it can be shown that in the same year the 35-mile section of the same highway from Philadelphia to Coatesville, where traffic was extremely heavy, made possible a reduction in the operating expense of motor vehicles amounting to \$1,300,000 or approximately \$37,000 per mile.

Relation of Service Value to Annual Costs for Hard-Surfaced Roads.—It can readily be shown that the service value of the improved roads of the State highway system as thus estimated, exceeds the average annual cost of the improvement. This is true even if we consider only the most expensive and durable types of improvement.

The average cost of durable construction in Pennsylvania for two-lane roads is about \$50,000 a mile. The annual cost for each mile of such construction, including interest and sinking fund on the capital outlay, plus the annual maintenance charge, estimated by the Pennsylvania Department of Highways, is about \$4,800 a mile, from which must be deducted the annual maintenance charge of about \$500 a mile for the dirt road which is replaced, or a net annual cost of \$4,300 a mile; whereas the average annual service value of hard-surfaced pavements on the State highway system in 1924 was about \$6,150 a mile.

Annual Service Value Exceeds Motor Vehicle Taxation.—The estimated annual service value of the hard-surfaced roads of the State highway system, in 1927, is \$76,800,000, as compared with the approximate sum of \$43,000,000 paid by motorists in motor vehicle license fees and gasoline taxes, in 1927. This means that there is a net saving of approximately \$33,800,000 to the motorists, in 1927, over and above the amount collected from them to support the State highway system.

CHAPTER II

THE HISTORY OF HIGHWAYS IN PENNSYLVANIA

Pennsylvania, known as the "Keystone State" from its position at the crown of the arch formed by the original thirteen colonies, has within its nearly rectangular borders an area of approximately 45,000 square miles. East and west its greatest length is approximately 300 miles. Between the Maryland and the New York lines the



*Old and New Markers on the Mason and Dixon Line
Between Pennsylvania and Maryland*

distance is a little over 160 miles. A modification of the general rectangular outline in the northwest corner furnishes a shore line on Lake Erie, and at the eastern border the Delaware River provides a navigable outlet to the sea.

The relief map reproduced in this report as Figure 1, shows that the most important physical features are the mountains which curve in a gigantic quarter circle from its southern border to its northeast corner. In its every aspect—climatic, economic, social, political—the character of the Commonwealth is modified by these almost unbroken highlands which separate its eastern and western portions.

Their influence in shaping the political subdivisions is clearly evident. Within the mountainous area the boundaries of the counties follow the curvilinear courses of the ridges and valleys. These ridges and valleys have exercised a controlling influence upon the location of the highways; and the transport survey indicates that they also have a marked influence on the use of these highways.

Southeast Area.—The mountains have a profound industrial influence. Like a wall they enclose to the southeast a quarter circle, embracing 14 counties, which is at once Pennsylvania's most fruitful garden and most productive workshop. Two-thirds of the area of this section is in cultivated farms. In comparison with the Commonwealth as a whole this section has only a sixth of the total area but includes more than a quarter of the improved agricultural acreage; and the value of its farm and dairy products is more than three-eighths of the total. Yet it is not solely an agricultural section; it is preeminent also as an industrial region. In it is Philadelphia, the State's largest city, and seven other cities that take high rank as industrial centers. Although its area is only 17 per cent of the total it is the home of about 40 per cent of the population, and the value of its industries is nearly 44 per cent of the total value of the production of all industries and mines. The importance of this industrial section is not due entirely to Philadelphia. Excluding the industrial output of the metropolis, it still produces more than a quarter of the total value of

all industries, and if Allegheny County, in which is situated the city of Pittsburgh, be also excluded, it produces half as much as all the remainder of the Commonwealth.

This highly productive agricultural and industrial area which is the home and workshop of approximately 3,500,000 people must necessarily require a large activity in transportation, and is shown by the transport survey to be of first importance as a producer of highway traffic.

Northern Area.—Beyond the mountain wall to the north lies another section which contrasts sharply in every respect with the southeastern area. This section, including 15 counties, forming a segment of a circle with the northern border as its chord, is heavily forested. Two-thirds of its area is classed as forest land, and less than a quarter as farm land; it embraces 28 per cent of the total area, but its farms include only 16 per cent of the improved agricultural land, and its farm and dairy products account for only 14 per cent of the total value of such products. In industries other than agriculture it ranks even lower, the value of its industrial production being only 4 per cent of the total. More sparsely populated than any other section, and the population of nine of its 15 counties decreasing, this section is not likely to make strong demands for transportation facilities. The fact, as developed by the survey, that this section forms a part of the area of lowest density of highway traffic receives, therefore, abundant confirmation in the general character of the section. Even its forests—once highly productive—no longer support an important industry. In 1860, Pennsylvania held leading rank in this industry, today it is forced to draw on outside territory for 84 per cent of the lumber and 74 per cent of the pulp wood to meet its own requirements. It is estimated that it will take some 50 years of careful conservation before the Commonwealth will be able to produce a sufficient amount of lumber to supply its own demands, so that it is reasonable to anticipate that for the next 15 years at least the revival of the lumber industry will have no considerable effect upon the population, production or traffic of this and other heavily forested areas.

Western Area.—West of the mountains and forming roughly the segment of another circle with the western boundary as its chord is an area which is second only to the southeastern section in the production of its farms. The 13 counties included in this section make up a fifth of the total area and include more than a quarter of the improved farm land. Fifty-five per cent of this area is in cultivated farms and the value of their agricultural production is 21 per cent of the total. Pittsburgh, the second city in population and the center of the steel industry, is in this section, and its industrial production is exceeded only by that of Philadelphia. Excluding Allegheny County this western area does not rank high as an industrial section.

In population and industry it is second to the southeastern area and it may therefore be expected to rank correspondingly in highway traffic, which fact is demonstrated by the survey. It is the principal seat of the oil industry, but as oil is transported largely in pipe lines this industry contributes to its importance as a highway traffic area, only through the transportation of materials for the drilling of wells and the maintenance of wells and pumping stations.

Central Area.—There remains a large section—more than a third of the total area—which is included in the vast curve of the mountains. Twenty-five counties are in this area. The slopes of the mountains are heavily forested and these forests constitute 50 per cent of the total area. In the valleys are fertile farm lands which make up a third of the farm area and which produce commodities valued at more than a quarter of the State's total agricultural production. But this section owes its greatest importance to its mines and quarries.

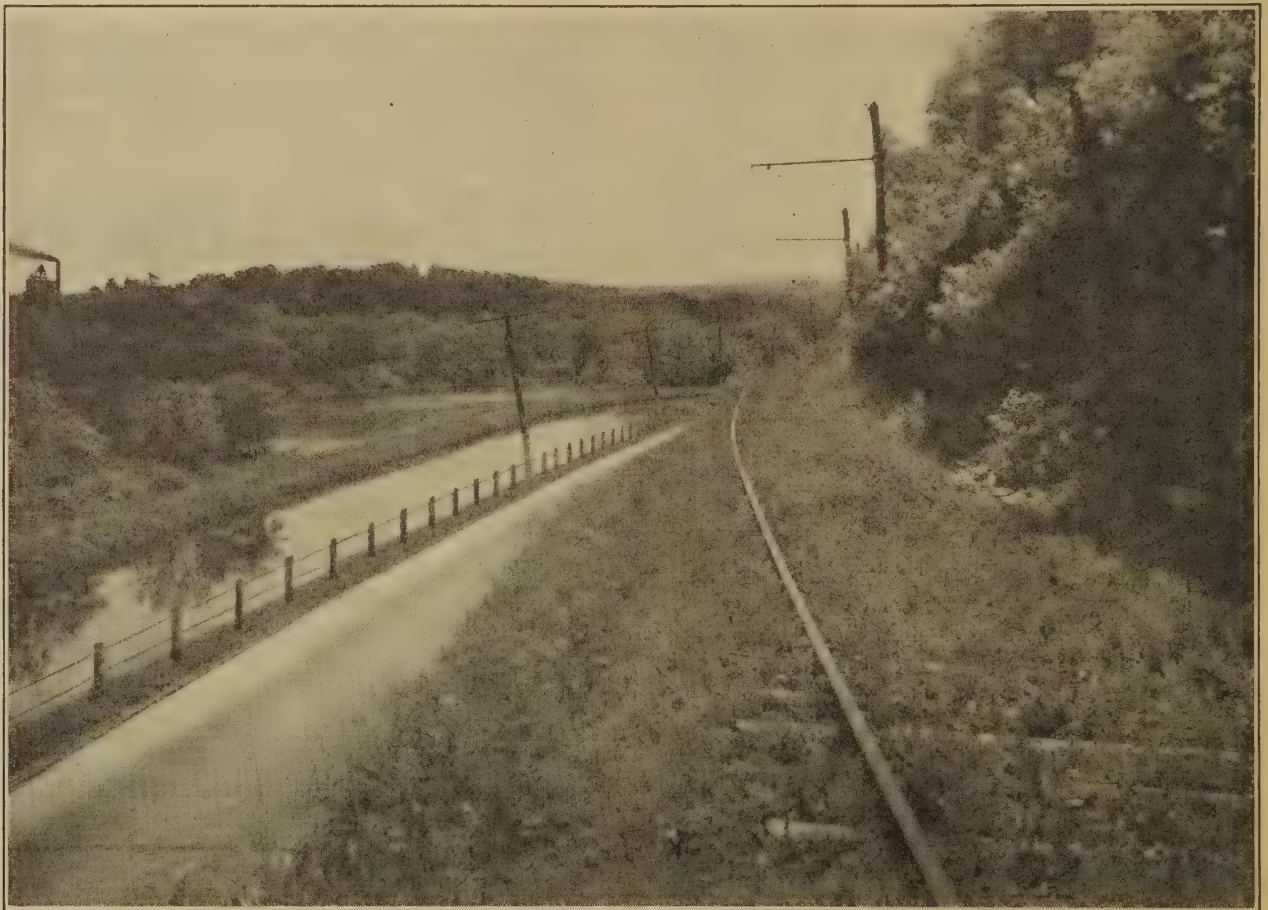
At the eastern extremity of the mountain arch, in the counties of Carbon, Columbia, Dauphin, Lackawanna, Luzerne, Northumberland, Schuylkill and Wayne are the fields in which practically all of the anthracite coal of the United States is produced. At the western extremity are the bituminous coal fields. Along the Susquehanna River, where it pierces the mountains, there is a

"river coal"⁸ industry which contributes heavily to the highway traffic of the immediate vicinity although it is of minor importance among the industries of the Commonwealth. It is to the anthracite coal fields that the cities of Scranton, Wilkes-Barre, Pottsville and Sunbury owe their industrial importance and their high rank as centers of highway traffic.

Transportation Facilities.—For the transportation of its people and the products of its indus-

transportation are the Monongahela, Allegheny, Ohio and Delaware Rivers and the Lehigh Coal and Navigation Company Canals. The Susquehanna River is too shallow for navigation. In the northwest corner the city of Erie owes its importance to its position on Lake Erie.

According to the reports made by railroads operating within the Commonwealth, they carried a total of 363,000,000 passengers and 827,000,000 net tons of freight in the year 1924, including



Electric Railway, State Highway, Canal and River South of Easton

tries Pennsylvania has approximately 13,500 miles of steam railroad lines, 4,000 miles of electric railway track largely in the cities, and a total of more than 100,000 miles of highways and streets of which the State systems, primary and secondary, include about 12,000 miles.

The principal arteries of internal water-borne

23,000,000 net tons of L. C. L. (less than carload lot) freight. These figures are for the entire mileage of these railroads, both within and without the Commonwealth. Figures are not available for

⁸ River coal is fine coal that is washed down from the collieries and is reclaimed by boats which pump the sand and coal from the river pockets and separate the coal by screening.

the haulage within Pennsylvania alone, but multiplying these totals by the percentage of the total mileage of the lines that lies within Pennsylvania an estimate of 134,000,000 passengers and 353,000,000 net tons of freight, including nearly 9,000,000 tons of L. C. L. freight is obtained.

Of the total tonnage of freight carried by the railroads, products of mines represented 63 per cent, manufactured goods 26 per cent, products of agriculture $5\frac{1}{2}$ per cent, products of animals $1\frac{1}{2}$ per cent and products of forests 4 per cent.

The electric lines, mainly within the cities, carry approximately 1,700,000,000 passengers annually. The amount of freight carried is negligible in comparison with that carried by the railroads.

From the observations made during the highway transport survey it is estimated that there

were transported in 1924 over the State highway system between 5,000,000 and 6,000,000 tons of freight, 60 per cent of which was classified as products of manufacture, 13 per cent as products of mines, 11 per cent as products of animals, 9 per cent as products of agriculture and 7 per cent as products of forests.

Of water-borne freight there were at Pittsburgh in 1922 approximately fourteen and one-half million tons carried on the Monongahela River, and about 4,000,000 tons on the Allegheny River. In the same year, traffic on Lake Erie through the port of Erie was a little over 2,000,000 tons, and the Delaware River at Philadelphia carried 19,000,000 tons. Canals carry an estimated tonnage of 1,000,000 annually.

THE DEVELOPMENT OF THE STATE HIGHWAY SYSTEM

As in other States the effective work of highway improvement has been done in very recent years, the great bulk of it under the administration and direction of the State Highway Department which was established in 1903, but did not have the supervision of a State highway system until 1912.

The early history of the roads, their administration and early highway legislation is much the same as in the other Colonial States.

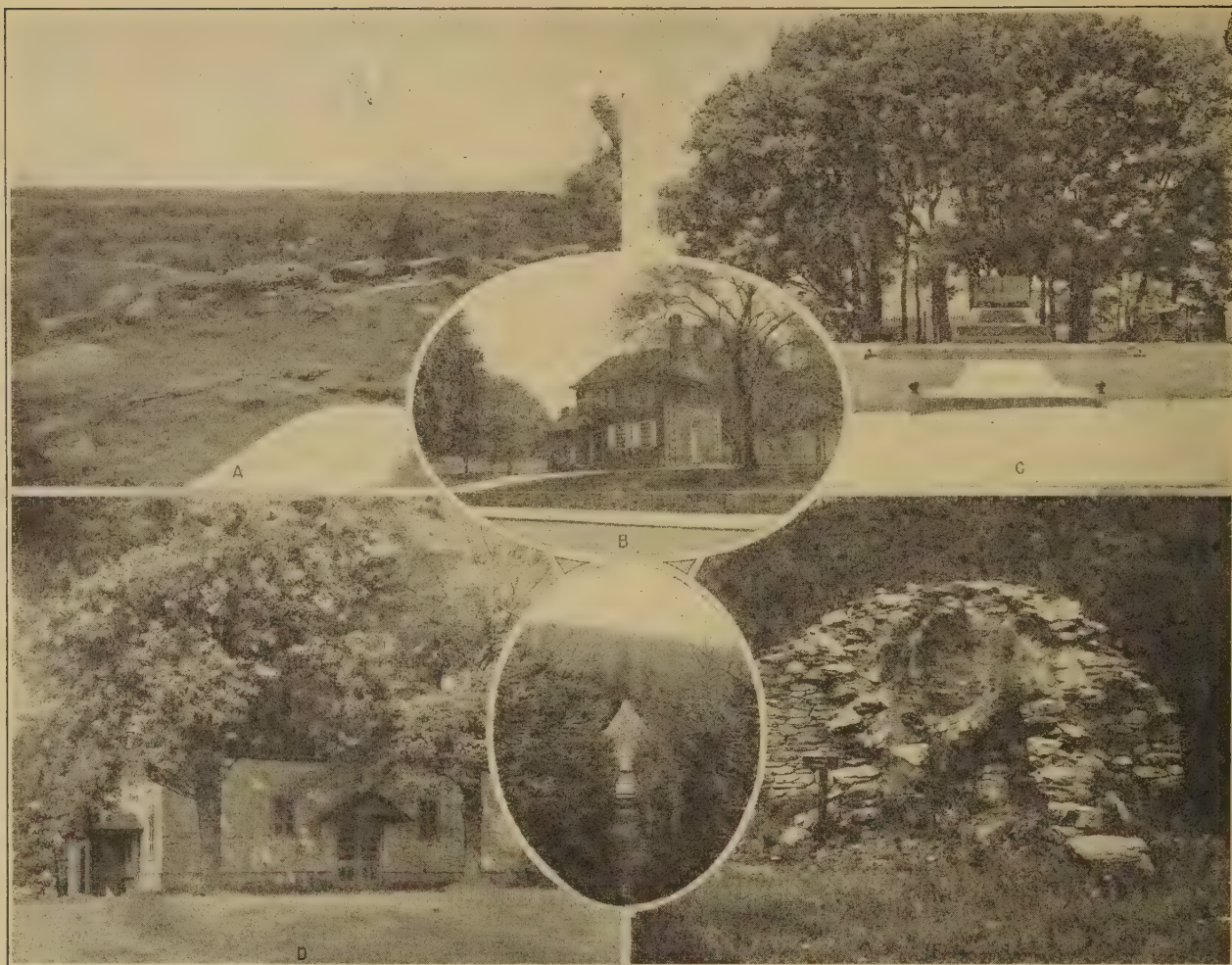
Among the early records (1711) are to be found descriptions of a road leading from a point on the Delaware River opposite the landing of John Reading to Fourth and Vine Streets in Philadelphia, long known as the "York Road," also of the Strasburg Road, the Lancaster-Philadelphia Road, and many others.

Of historic importance are the Forbes Road (now the Lincoln Highway) opened as a military highway to the West by General Forbes in 1758; the Lancaster Turnpike, the first "artificial" road constructed in Pennsylvania and one of the first in the United States; the "Necamolin Trail," used by Major Washington when, as an envoy of Governor Dinwiddie of Virginia, he carried a message to the French commander at Fort Le Boeuf in

1750; and the National Pike which crosses the southwestern corner of the Commonwealth on its way from Cumberland to the Ohio River, and which was opened as a military road by General Braddock on his trip to the relief of Fort Duquesne on the present site of Pittsburgh.

The Lancaster Turnpike, $62\frac{1}{4}$ miles in length, was completed at a cost of approximately \$444,000 in 1794. It was constructed by a turnpike company incorporated in 1792, the first of a long line of similar companies which sprang into existence during the following eighty years. During the early years of the nineteenth century many miles of such roads were constructed. The records show that upwards of 2,500 miles were in operation in 1831, and a large mileage was added during the forties and during the period immediately following the Civil War and up to 1874 when the present State constitution was adopted.

The Commonwealth contributed approximately \$2,000,000 toward the construction of these turnpikes; but almost without exception they proved to be unprofitable ventures. Many of them were poorly constructed, and but few yielded sufficient revenue to pay for their maintenance. The lack of maintenance caused many of them to be aban-



Points of Historic Interest on the State Highway System in Pennsylvania

A. Gettysburg Battlefield from Little Round Top. B. General Washington's headquarters at Valley Forge. C. High Water Mark of the Confederacy at Gettysburg. D. Kennett Square Meeting House. E. Site of birthplace of President Buchanan at Mercersburg. F. Ruins of Thaddeus Stevens' Iron Furnace at Caledonia Park on the Lincoln Highway.

done and failure to maintain others caused their condemnation. The maintenance of the abandoned and condemned roads devolved upon the counties or townships, boroughs and cities through which they passed, but the change in authority did not result in greatly improving the road conditions. In many instances, in fact, conditions became worse, so that it came to be remarked that a common dirt road was a bad road because it was generally impassable six months in the year, but an abandoned turnpike was worse because it was bad all the time.

At the time of the establishment of the State Highway Department in 1903 it was reported that there were still in use over 1,100 miles of toll roads. With but few exceptions this mileage is now free of toll, there being but 20 to 30 miles remaining. All turnpike roads traversed by State highways are now free except those designated as State highways by the Act of 1925.

Interest in the improvement of the roads revived with the vogue of the bicycle and, in order that the public might be informed as to the value of "good roads" and the best methods of building

them, William H. Rhawn and other public-spirited citizens of Philadelphia and vicinity, acting through the University of Pennsylvania, offered in 1889 a prize for the best paper on the construction and maintenance of common roads. As a result of the interest thus aroused a number of

remedy the situation. This act, passed June 12, 1893, enabled the taxpayers of townships and road districts to contract for the making of roads at their own expense, including the payment of the salaries of the township or road district officers, in consideration of which the levy and collection of road taxes was to be waived. Of greater interest is the fact that 25 townships still work under this act.

Under the act of June 26, 1895, a county road system was organized in Allegheny county and afterward in other counties. At present a number of counties are working under this act by reason of their maintenance of abandoned or condemned turnpike roads.

With the coming of the automobile the voice of the motorist was added to that of the cyclist, and their combined influence, together with the inability of the local authorities to provide funds for the maintenance and repair of the roads, led finally to the passage of the act of 1903 providing for the establishment of a State Highway Department.

Under the provisions of this act, by which the Commonwealth agreed to pay two-thirds of the cost of reconstructing township roads, several hundred miles of road were constructed, principally of telford-macadam but including also smaller mileages of brick, concrete and bituminous penetration macadam.

Finding that the counties and townships were slow to realize the benefits to be obtained through the assistance tendered by the Commonwealth, the proportion of State aid was increased to three-fourths of the cost by the Act of 1905, the balance being made payable by the county and township according to the terms of agreement in each particular case.

It was not until the passage of the Act of May 31, 1911, that a system of State roads to be constructed and maintained at the sole expense of the Commonwealth was established. This act retained the system of State aid but reduced the percentage payable by the Commonwealth to 50 per cent.

The State highway system established in 1911 included about 8,000 miles. With subsequent additions it included about 10,274 miles in 1924.

Rates of Toll on the Cumberland Road in Pennsylvania.	
Every score of sheep	6¢
" " Hogs	6¢
" " Cattle	12¢
" " Horse and rider	4¢
Every led or drove horse, Mule or Ass	3¢
" " Sled or sleigh drawn by one horse or pair of oxen	3¢
" " Horse or pair of oxen in addition	3¢
" " Bearborn, Sulky, Chair or Chaise with one horse	6¢
" " Horse in addition	3¢
Every Chariot, Coach, Coachee, Stage, Phaeton or Chaise with two horses and four wheels	12¢
" " Horse in addition	3¢
Every other carriage of pleasure by whatever name it may be called, the same according to the number of wheels and horses drawing the same	1¢
Every cart or wagon whose wheels do not exceed three inches in breadth, drawn by one horse or pair of oxen	4¢
" " Horse in addition	3¢
Every cart or wagon whose wheels exceed three inches and does not exceed four inches in breadth, for every horse or pair of oxen drawing the same	4¢
Every cart or wagon whose wheels exceed four inches and do not exceed six inches in breadth, for every horse or pair of oxen drawing the same	4¢
Every cart or wagon whose wheels exceed six inches and do not exceed eight inches in breadth, for every horse drawing the same	4¢
All carts or wagons whose wheels exceed eight inches in breadth	FREE
Any person refusing or neglecting to pay toll, a fine of	

Toll Rates Posted on Old Toll House on the National Pike

townships in the vicinity of Philadelphia constructed several miles of telford-macadam road.

Of curious interest as an indication of the state of the public mind at the time is the first of the acts to be passed by the General Assembly to

Of this mileage 3,953 miles constituted the primary system, designated as such by the Department of Highways in 1919. The remaining 6,321 miles constituted the secondary system. About 1,200 miles of State highways were added to the system by the 1925 General Assembly, and came

under State maintenance on June 1, 1926. Together with State-aid roads not included in the State highway system, but maintained by the Department, the total mileage of State and State aid highways June 1, 1926, was approximately 12,000.

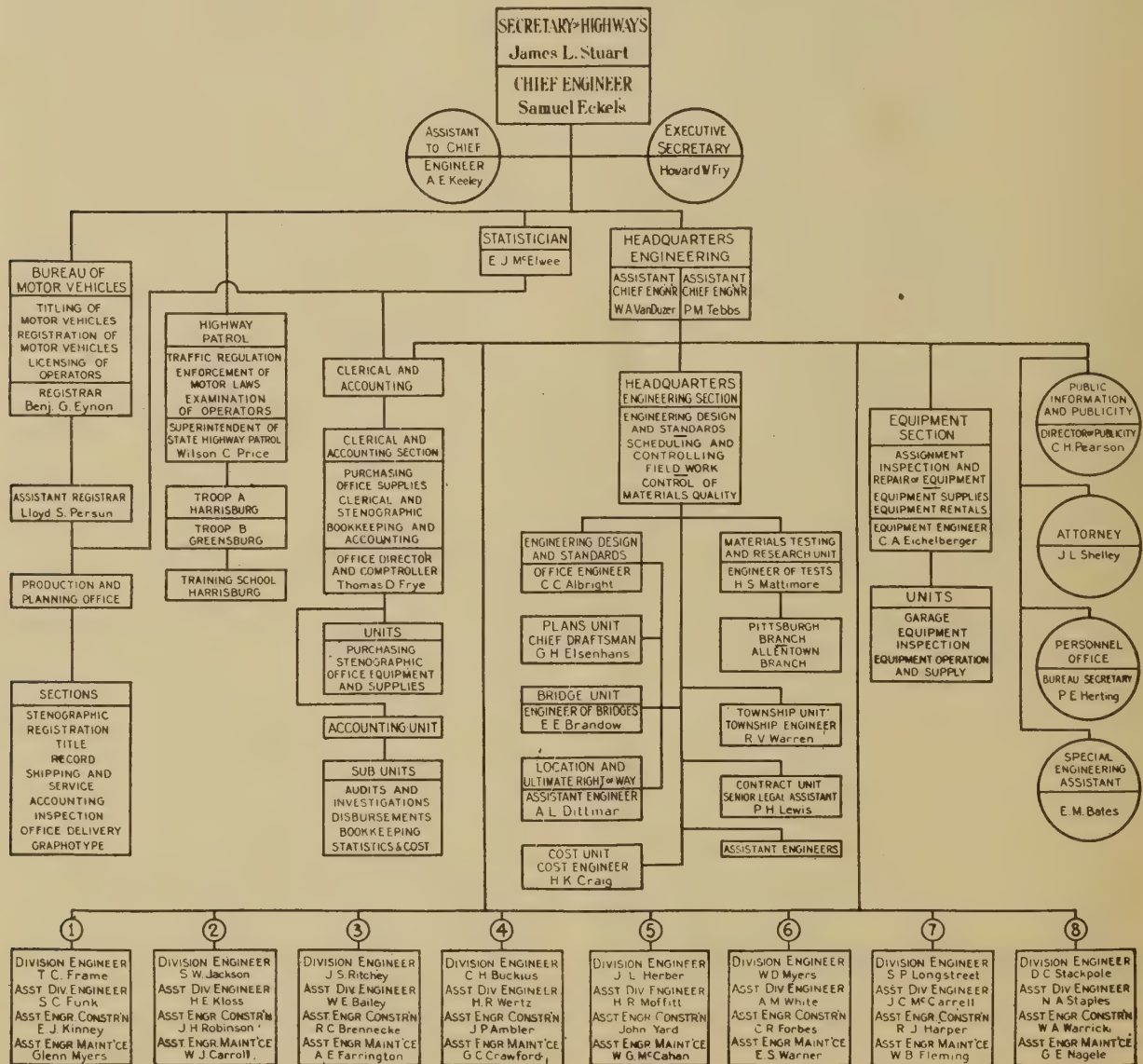


Fig. 3—Organization and functional chart of the Department of Highways, Commonwealth of Pennsylvania

ORGANIZATION OF THE DEPARTMENT OF HIGHWAYS

The organization of the Department of Highways, as shown in Figure 3, is headed by the Secretary of Highways, who is appointed by the Governor. In him is vested authority to appoint all other employees of the Department with the approval of the Governor.

The chief engineer is next in authority and has been delegated all powers of the secretary. Reporting to the chief engineer is a group of staff engineers, who supervise the varied activities of the central offices; eight division engineers, who

and as each project is authorized for performance it is checked against the budget and the budget amounts for each purpose are not exceeded. During the performance of each project there is close control over the disbursements and costs.

The Commonwealth is divided into eight engineering divisions, each in charge of a division engineer. These division engineers have supreme authority in their division in all matters except questions of policy. Each division engineer has an engineering force capable of supervising all



The State Capitol at Harrisburg

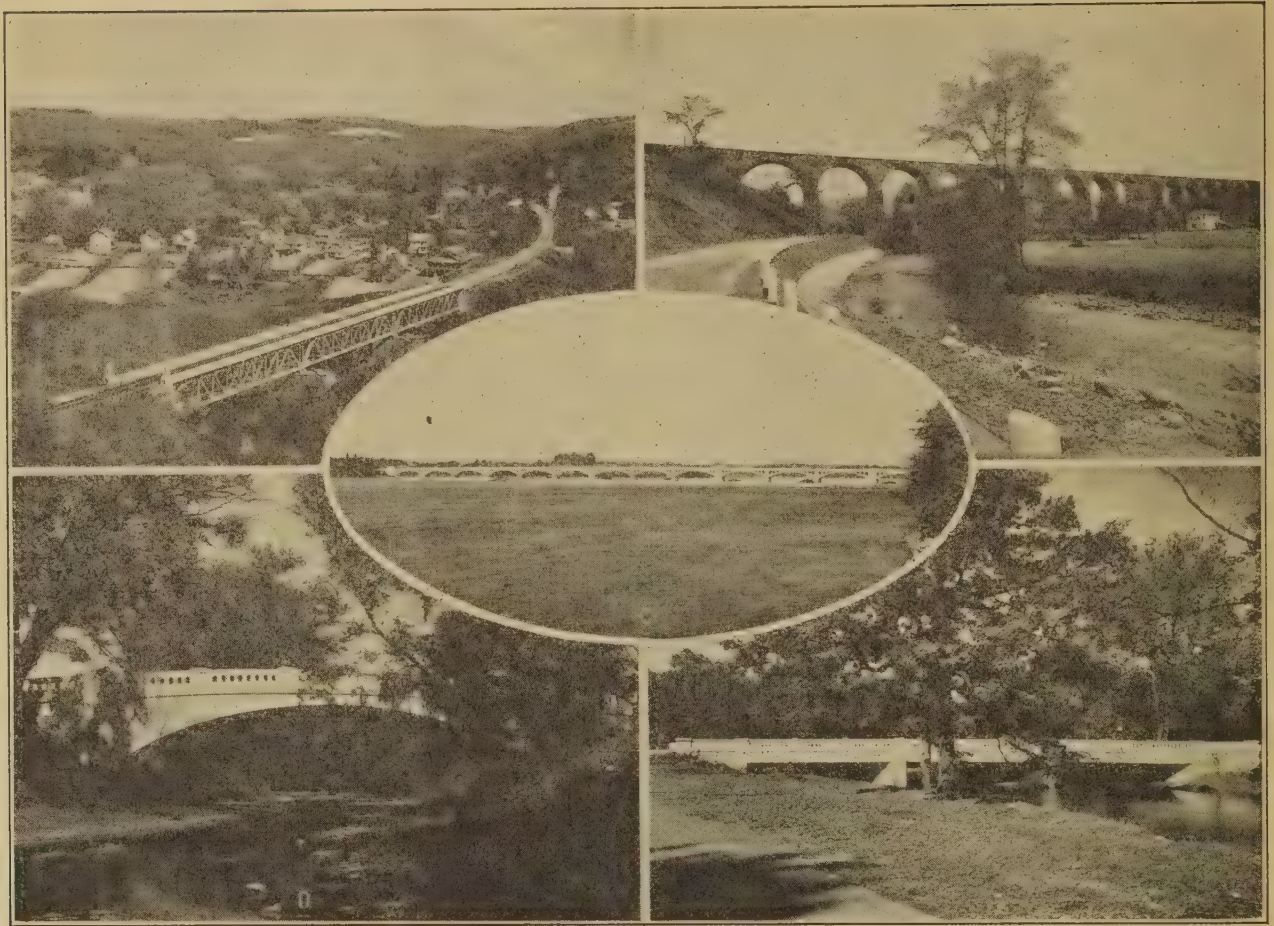
are responsible for all field work; and the registrar of motor vehicles.

All questions of policy, planning and scheduling, contracting and control of all highway work, purchasing, inspection and control of all materials and equipment, as well as the preparation of all engineering standards and design, are under the supervision and control of the headquarters executive staff.

All expenditures of the Department are controlled through a budget system. The annual budget deals with the sources and amounts of revenue available and distributes the proposed expenditures to certain definite purposes. The items of the budget comprise the program of projects

construction and maintenance work in his territory, including that performed for counties, townships and boroughs. The division engineering forces make surveys, prepare all plans according to departmental standard designs, and after the work is advertised and awarded by the central office, or authorized to be done by departmental forces, supervise its performance. The performance of all maintenance work done by department forces is under the direct supervision of 52 maintenance superintendents who report to their respective division engineers.

The yearly collection of about \$25,000,000 for the titling and registration of motor vehicles and the licensing of motor vehicle operators, involv-



Group of Bridges on the Pennsylvania State Highway System

A. Route 9, Wyoming County, Bridge Over Tunkhannock Creek at Nicholson. B. Route 296, Susquehanna County, Erie Railroad Bridge Over Highway and Canawacta Creek. C. Bridge Over Susquehanna River Between Dauphin and Cumberland Counties at Clarks Ferry. D. Route 23, Lycoming County, Bridge Over Larrys Creek. E. Route 123, Bridge Over Yellow Breeches Creek Between York and Cumberland Counties.

ing over 5,000,000 transactions annually, is handled through the central office by the Bureau of Motor Vehicles. This branch of the Department also deals with the revocation of licenses of those who violate the motor vehicle laws.

The highway motor patrol has an authorized strength of about 350 men. Its major activity is the enforcement of the motor vehicle laws on the State highways and rendering assistance to the motoring public. A separate part of the patrol organization is responsible for the examination of prospective motor vehicle operators. Separate details weigh truck loads on the highways, while others are concerned with the headlight law enforcement.

During the peak of the working season about 25,000 people are engaged in work under the

supervision of the Department, of which from 12,000 to 14,000 are on the State highway payroll and the remainder are employed by highway contractors. The foremen, caretakers and laborers employed by the Department on maintenance work at times total 9,000 to 11,000, while as many as 2,500 to 3,000 persons are on the salary payroll. The latter group comprises the engineering and clerical forces of the central office, including the Bureau of Motor Vehicles and the Motor Patrol, and the corresponding forces of the 60 field offices.

During the working season equipment valued at about \$9,000,000 is used in State highway work, including Department equipment valued at about \$3,500,000, rented equipment about \$500,000, and equipment used by highway contractors valued at



Motor Patrol Squad Ready for Practice Cruise

about \$5,000,000. Among the major equipment operated at the peak of the working season are:

2,170 motor trucks	1,200 concrete mixers
540 road rollers	1,400 units of road equipment, such as sprinklers, sweepers, stone spreaders, road machines
340 tractors	
230 steam shovels	
130 cranes	

During the winter the Department operates approximately 600 trucks and 100 tractors with snow plows to keep the main traveled highways open.

Accomplishments of the Department of Highways Since 1919.—When, in 1919, it became possible, as a result of the first \$50,000,000 highway bond issue, to undertake an extensive program of road construction, the Department designated 3,953 miles of principal highways as the primary system, and undertook to complete the paving of this primary mileage as rapidly as possible. To that purpose it devoted practically the entire proceeds of the first bond issue. At that time approximately 1,800 miles of this system had already

been improved. During the years 1919-1922 about one thousand miles of new construction were completed.

Continuing the same policy, the last administration (1923-1926) applied approximately \$40,000,000 of the second bond issue of \$50,000,000 to the completion of the primary system, and at the end of 1926 the remaining 1,100 miles were practically completed, with contracts in force to complete the paving of the small remainder or to complete the grading and drainage of sections upon which pavements will be laid in the near future. Thus in eight years the Commonwealth has realized its dream of a paved system of main arterial highways providing uninterrupted facilities for travel at all times to all parts of the Commonwealth.

While this extensive program has been under way on the primary system, considerable progress has also been made in the paving of the secondary system, consisting of the remainder of the State highway system. Approximately 1,300 miles of the secondary roads had been improved up to 1919. During the administration of 1919-1922

approximately 1,100 miles were paved. During the administration 1923-1926 about 1,000 miles of new hard-surfaced roads were added to the secondary system which, with the mileage previously improved, gives a total of about 2,100 miles of new hard-surfaced roads constructed on the secondary system since 1919, and a total of 3,400 miles of improved roads in that system at the end of the year 1926.

In addition to the improved mileage on the primary and secondary system, nearly 600 miles of State-aid roads had been constructed in 1926. With this mileage the combined State and State-aid systems now have an aggregate length of about 12,000 miles, of which, at the close of the year 1926, approximately 8,000 miles had been improved by hard-surfacing, the balance of 4,000 consisting chiefly of earth roads and a small mileage of shale and gravel roads or roads to which some stone has been added to help carry the traffic.

Thus at the end of 1926 there were in the combined State and State-aid system two miles of improved roads for each mile unimproved. Without considering the 1,200 miles of unimproved roads added to the system in 1926, the ratio is nearly three miles of improved to one unimproved. An idea of the progress that has been made during the eight-year period can be formed by comparison of this condition with that of 1919 when there was but one mile improved to each two miles unimproved.

The administration of the Department of Highways during the four years 1923-1926 involved

the general supervision of expenditures amounting to more than \$250,000,000. Of this amount about \$190,000,000 was spent on the State and State-aid highway systems and the balance on roads not included in either of those systems. The program of expenditures on State and State-aid highways is about 50 per cent in excess of that of the preceding four-year administration, while previous to 1919 the amount of money expended was very small compared with the present program.

The \$190,000,000 State and State-aid road expenditure was financed by funds derived from the following sources:

Motor registration receipts and gasoline tax	\$91,000,000
Bond issue proceeds	48,100,000
General State revenues	10,500,000
Federal aid	14,300,000
Local share of work jointly financed	26,100,000
Total	\$190,000,000

The \$10,500,000 from general State revenues was made available by old appropriations. The policy was adopted in 1925, of financing the entire State highway program from the proceeds of the motor vehicle registration fees and gasoline taxes, including the entire cost of maintaining the 12,000 miles of State and State-aid highways and the general operations of the Department; and, in addition(the interest and sinking fund demands of the State highway construction bonds.

ROAD MAINTENANCE

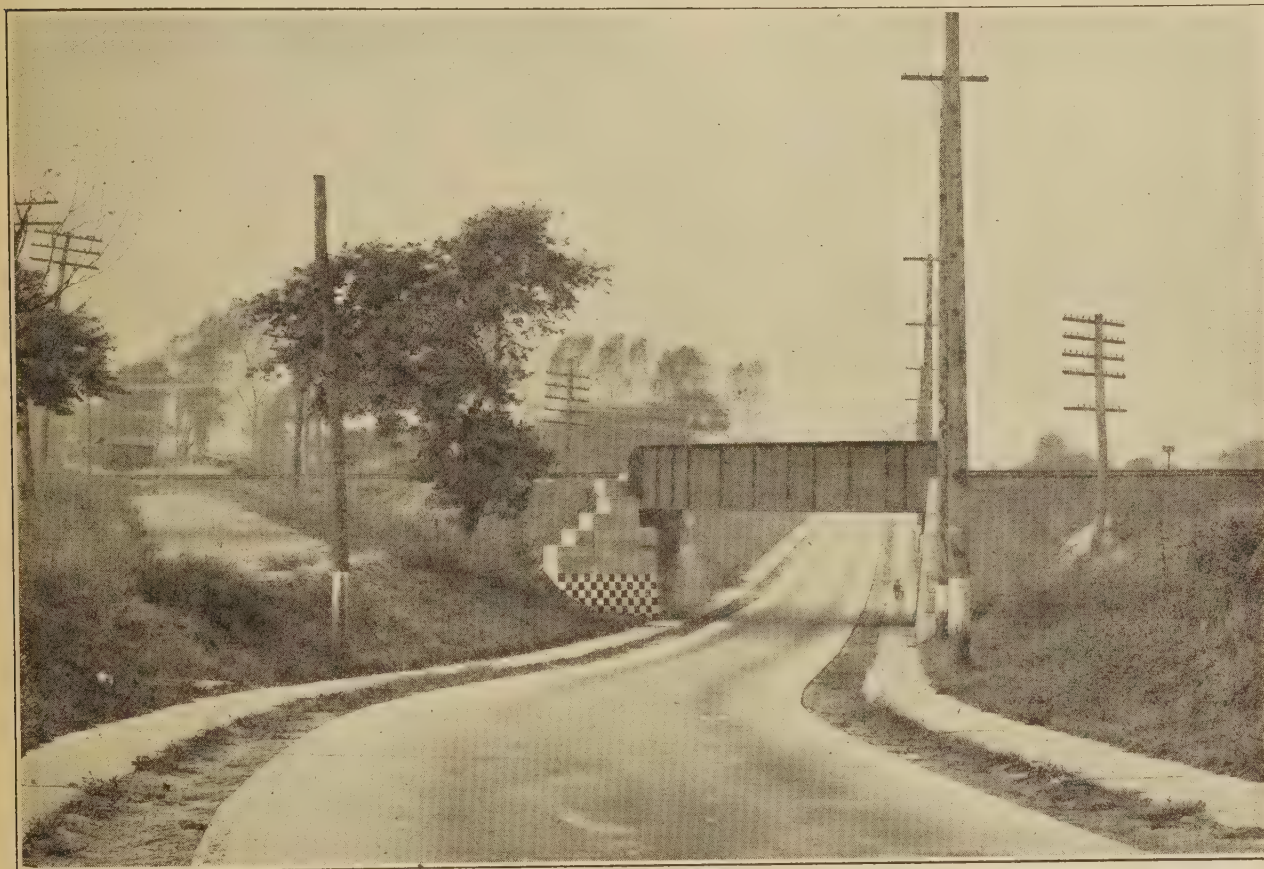
On December 31, 1926, there were 12,033 miles in the State and State-aid highway systems, of which 4,150 miles were improved with pavements of reinforced cement concrete, or with brick, block, bituminous concrete and sheet asphalt pavements on cement concrete base; 3,777 miles were improved with bituminous surface-treated or penetration macadam, or with bituminous concrete or sheet asphalt on stone base, or brick or stone block on gravel or stone base; and 4,106 miles

consisted principally of earth roads, including, however, a small mileage temporarily surfaced with shale or gravel or to which had been added in some cases a small quantity of broken stone.

With the exception of a small mileage of State-aid roads not included in the State highway system, these roads are maintained solely at the expense of the Commonwealth. State-aid roads are maintained at the joint expense of the Commonwealth and the local communities.

The maintenance expenditures of the Department reach a total of approximately \$20,000,000 a year, including expenditures for replacement, as well as resurfacing, and the various items of general maintenance, and including also expenditures for grade crossing elimination, snow removal, widening of dangerous curves, guard rail construction, etc.

this danger an effort is being made to minimize the number and severity of accidents by placing flashing signals, by painting checkerboards on the pavements, etc., as a warning to the traveler that he is approaching a grade crossing. The program during the years 1923-1926 resulted in the elimination of 254 crossings, 177 by relocation of the roads to avoid the crossings.



Grade Crossing Elimination on Route 180 in Delaware County

The latter items the Department recognizes as essential to the provision of adequate, safe and convenient highway transportation service, and it is, therefore, devoting no small part of its available revenues to the maintenance and gradual extension of the service and safety of the highways by these means.

For several years the Department has engaged in a very extensive program of grade crossing elimination, and pending the final elimination of

There are still about 1,200 grade crossings left on the State highway system, about 500 of which are on the primary system and somewhat over 700 on the secondary system. Of this total number 217 have been classified as very dangerous, 381 as less dangerous and somewhat over 600 as least dangerous; and it is the policy of the Department to consider the respective crossings for elimination in the order of their danger, regardless of whether the particular section of road on

which they are located is involved in the construction program.

With a similar object—that of promoting the safety of the highways the Department has carried on extensively the work of erecting guard rails on embankments, of painting traffic lines on the surface of the highways, of whitewashing telephone poles as an aid to night travelers, of erecting warning signs and recently of installing reflecting signals.

The snow removal program has been extended each year as the paving of highways between the various centers of population has been completed. The organization for snow removal maintains a snow alarm system which enables the snow removal forces to get under way as soon as the snow has reached the depth of two inches. The Department has also made extensive installations of snow fence, realizing that the prevention of drifts is cheaper than their removal.



Surface Marking on the Highway Indicating the Approach to a Railroad Grade Crossing Near Hummelstown.



Cable Guard Fence prevents Many a Serious Accident

Snow removal is one of the many activities in the line of service to the traveling public which is greatly emphasized. The main roads must be kept open every day in the year, otherwise there is economic loss. Snow removal, however, is not solely of service to the traveling public; it also materially reduces the road maintenance costs.

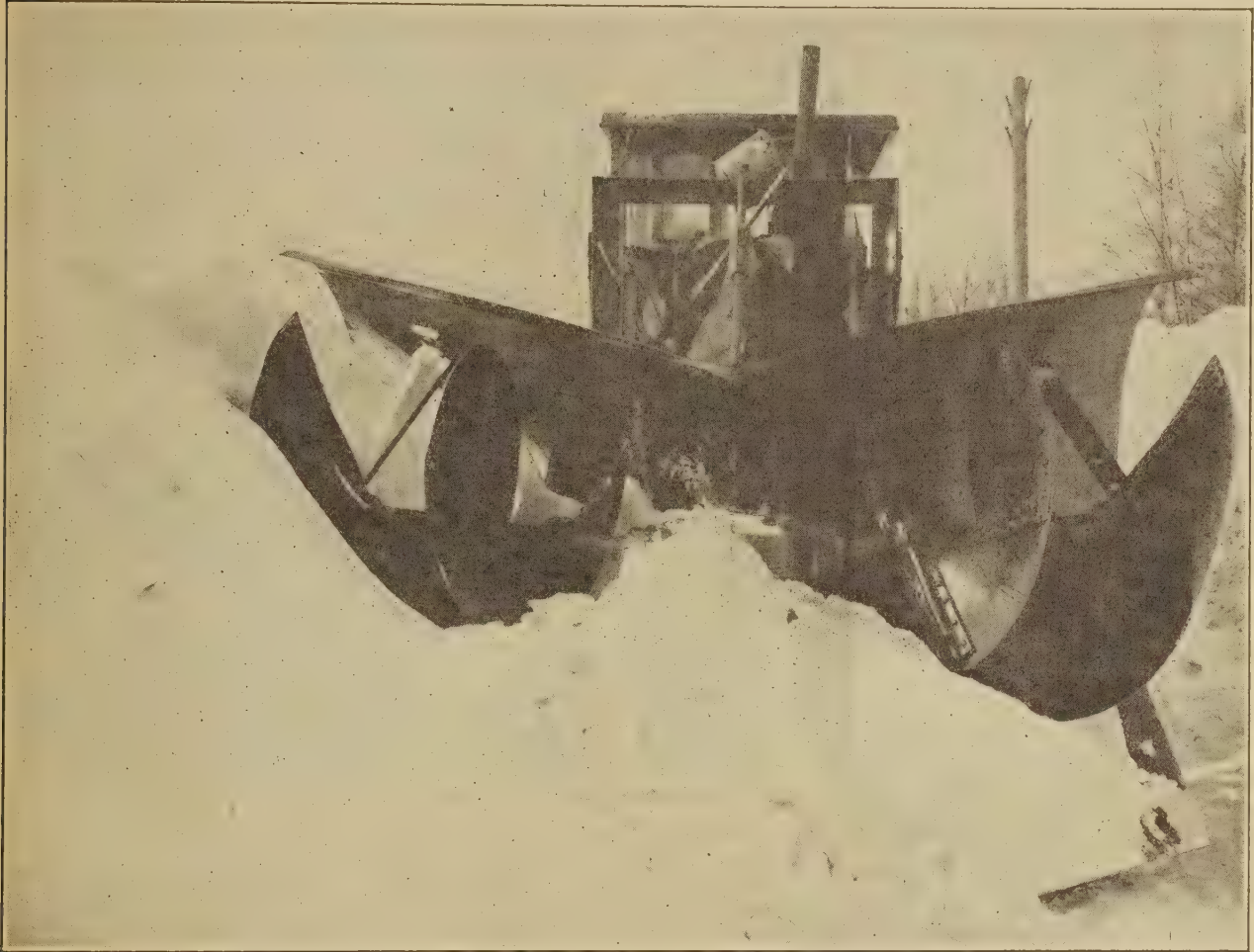
The care and attention given to these features of its work are in harmony with the Department's conception of its function as that of providing adequate facilities for highway transportation, not merely that of building and maintaining the highway structure.

It is its belief that the work of repairing, replacing and improving the existing surfaces and structures must be continued without cessation, in order that the highways shall continue to render the service for which they are built, and that it should constantly endeavor to maintain a standard of service on each separate link of the highway system consistent with the needs and importance of the traffic.

ROAD CONSTRUCTION POLICIES

It has been the aim of the Department in every instance to determine the design of the pavement on the principle of providing adequately for the present and estimated future traffic needs at the least annual cost. Its policy has been never to

such surfaces have not been constructed even though they may have been adequate to meet the immediate traffic needs. In some cases where the traffic has been very light and it has appeared that it would not materially increase for 15 or



Rotary Snow Plow in Action Near Ridgway

build an expensive pavement where one of the less costly surfaces of the flexible type would serve the traffic for a reasonable period at a lower annual cost. If, however, it has seemed probable that a development of truck traffic would occur which would destroy a surface of the flexible type before the expiration of its economic life,

20 years, the highways have been improved by progressive construction. In such cases a surface of bituminous surface-treated macadam has been built at about half the cost of a more durable pavement. Such surfaces are expected to be adequate for the traffic for a great many years; and when the traffic warrants the further improve-

ment, it is the intention to build the more durable pavement over the existing surface, thus salvaging the initial investment and utilizing its strength as added support for the pavement.

The maximum right-of-way width established by the Governor and Council of the Colony at 50 feet in 1700 remained by reenactment the law of the Commonwealth until June 7, 1907, when it was increased to 80 feet and again on April 6, 1921, to 120 feet.

The General Assembly in 1925 also conferred upon the Secretary of Highways the power, with the approval of the Governor, to fix the ultimate right-of-way width on any State highways up to the maximum width of 120 feet, and by filing a

plan with the register of deeds in the respective county involved to preclude the payment by the public of damages for any improvements made within the reserved ultimate right-of-way lines after the filing is made. The Department has laid out an extensive program of surveys from which plans are being prepared and filings will be made in the near future on the more important highways leading into the principal centers of population. It is the intention to continue this program until the ultimate right-of-way has been established on all State highways. This is a particularly important measure to provide adequate width for widening of highways as traffic increases, and it will save future generations millions in property damages.



Chester Pike at Ridley Park Borough Before and After Widening

CHAPTER III

THE HIGHWAY TRANSPORTATION SURVEY

The general purpose of the highway transportation survey was to obtain detailed data regarding the volume and type of traffic on the State highway system and to estimate the future traffic importance of the various routes and sections of routes. The information so obtained is necessary for the establishment of a definite plan of highway improvement based on traffic needs and for the establishment of a highway budget for a period of years.

The survey, cooperatively conducted by the Pennsylvania Department of Highways and the United States Bureau of Public Roads was begun in November, 1923, and continued for a period of one year.

Prior to the beginning of the survey the Pennsylvania Department of Highways had conducted a series of traffic counts at approximately 1,000 points on the State highway system. These counts were made during the months of May, July and October, 1923, and February, 1924. Each operation consisted of a record of the number of passenger cars and trucks for from two to six days in each of the above months. The hours of operation at each station varied from 12 at minor stations to complete 24-hour counts at the more important stations. The data obtained were valuable in the selection of the most advantageous points at which to record traffic during the period of the transport survey and the density data for all stations were combined in the traffic analysis of the Pennsylvania highways.

During this survey, traffic data were recorded at 352 points on the Pennsylvania highways. At 82 of these points complete motor truck information including weights was obtained, as well as

the density of traffic of all types of vehicles. These stations were located at key points on the principal highways in different sections in order that motor truck utilization in various parts of the Commonwealth could be determined.

At the remaining 270 stations all truck data except weights, and the density of all types of traffic were recorded.

Each operation consisted of a ten-hour observation period alternating between 6 a. m. to 4 p. m., and 10 a. m. to 8 p. m. In addition to the regular day operations a sufficient number of night operations, from 8 p. m. to 6 a. m., were made to enable a reasonably accurate adjustment of all traffic records to a 24-hour period. Detailed passenger car data were obtained by a special party operating throughout the year at selected stations. The operating schedule provided for an accurate distribution of operations so that each hour of the day, day of the week, and season of the year for each station was correctly represented in the summary of traffic information. The field operating schedule was constructed so as to avoid duplicate recording of traffic, which would result if two or more stations, located near each other on the same route, or on connecting routes, were operated on the same day.

From information regarding hourly, daily and seasonal variations in traffic obtained during the survey, the earlier counts conducted by the Pennsylvania Department of Highways were adjusted to an average daily traffic for the year period. The inclusion of these counts provides definite information as to traffic at 1,351 points. The location of each of these traffic stations is shown in Figure 4 and 4a.

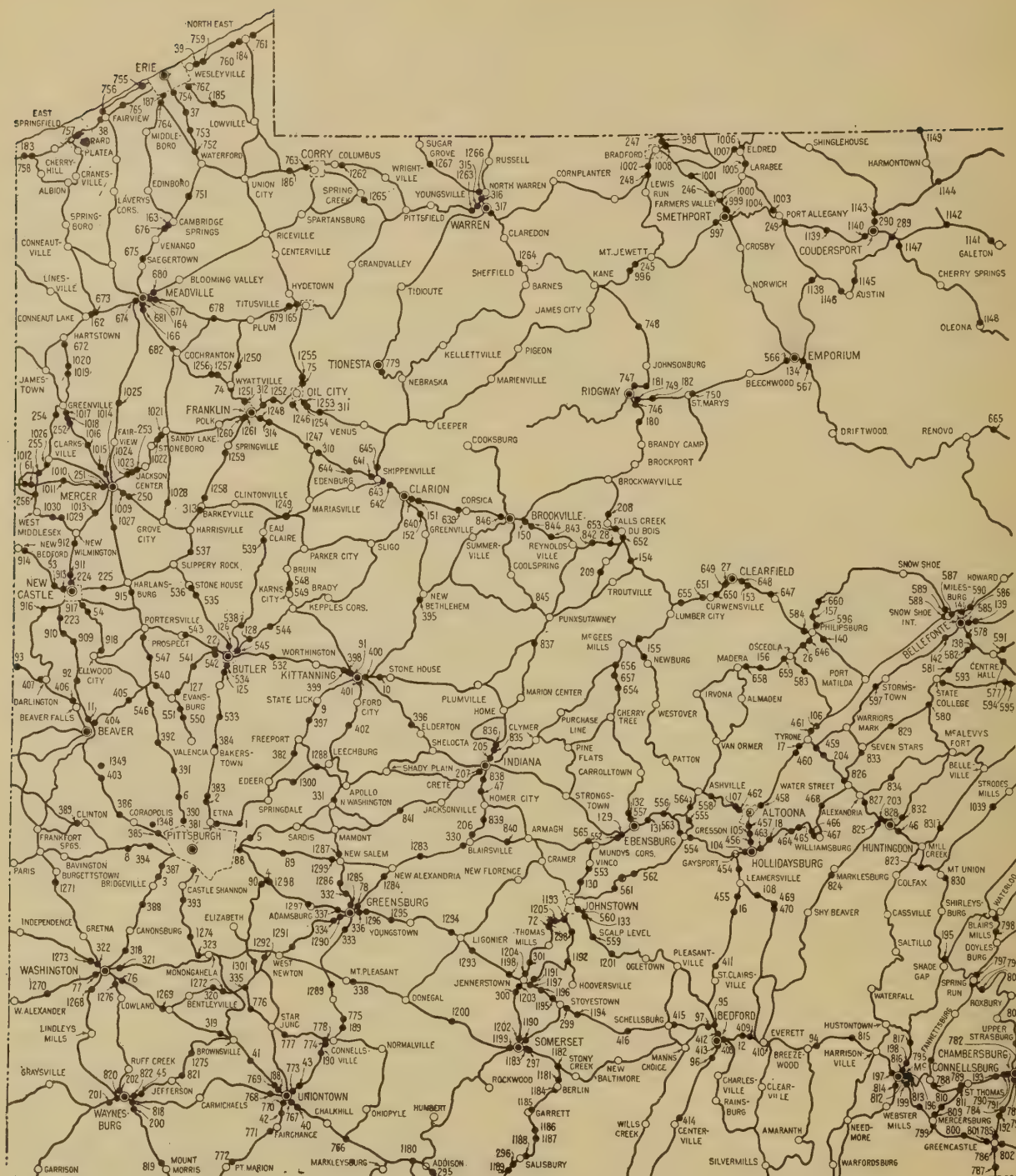


Fig. 4—Map of Pennsylvania showing the location of traffic survey stations (west section)

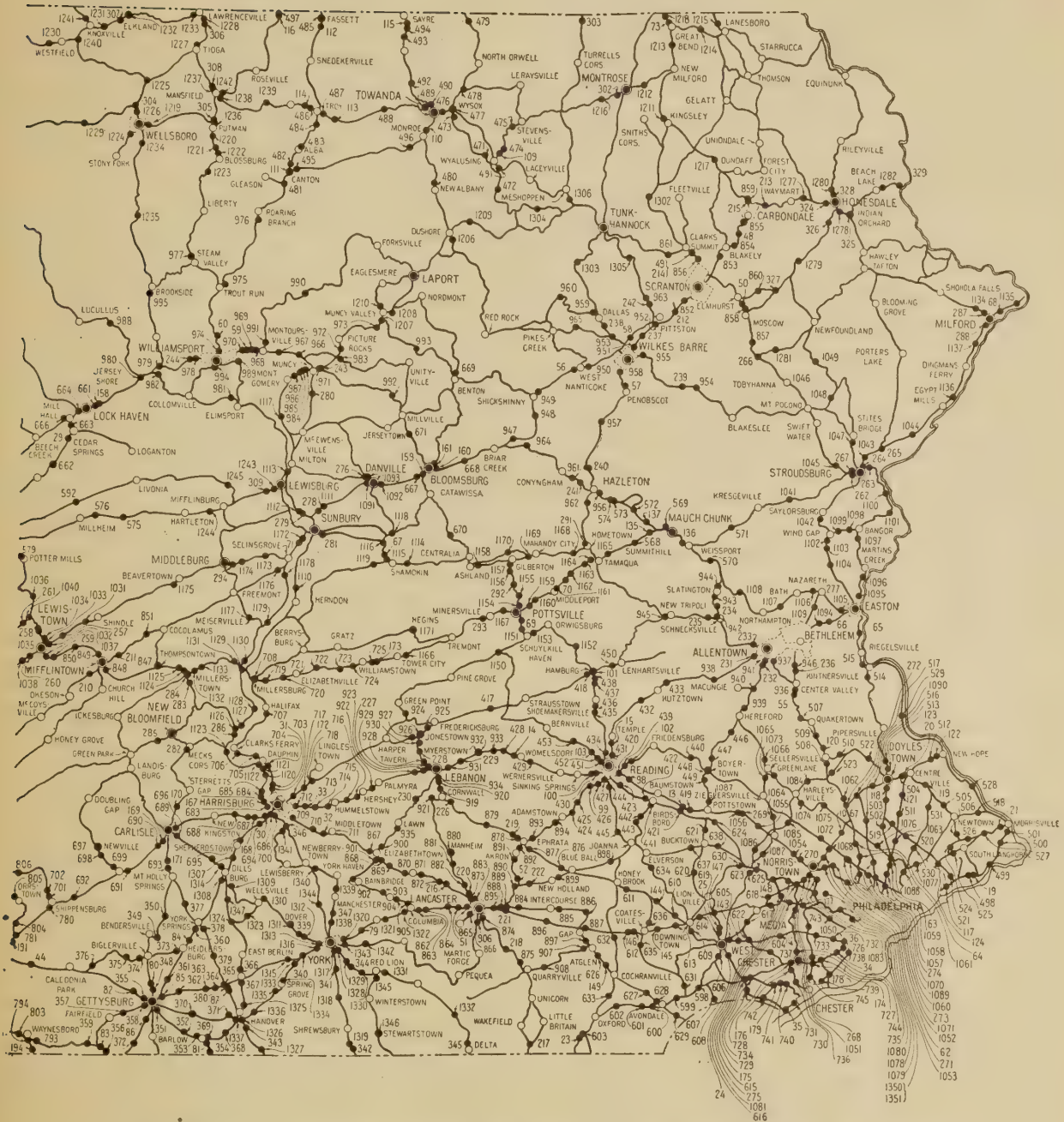


Fig. 4a—Map of Pennsylvania showing the location of traffic survey stations (east section)

THE DENSITY OF MOTOR VEHICLE TRAFFIC IN 1924

As previously stated there were in 1924 more than 93,000 miles of rural highways in Pennsylvania, of which 10,274 miles had been officially designated as the State highway system. The highways of the State system, in turn, were classified according to their importance as the primary and secondary systems, the former coinciding, but for a few minor exceptions, with the Federal-aid system. In the following discussion the term *State highways* refers to the combined primary and secondary systems.

Annual motor vehicle traffic⁹ on the 3,953 miles of the primary system during 1924 was 1,516,575,000 vehicle-miles. On the 6,321 miles of the secondary system the annual traffic during the same period was 865,415,000 vehicle-miles. The preponderating importance of the State highway system is to be seen in the fact that annual traffic on the remaining 83,000 miles of rural highways, namely, the State-aid, county and township roads, which constitute 89 per cent of the total mileage (was estimated as 1,105,220,000 vehicle-miles. The State highway system, therefore, with but 11 per cent of all the rural road mileage in Pennsylvania, carried 68.3 per cent of the total annual motor-vehicle-mileage on the rural highways.

The daily volume of traffic on the different parts of the State highway system varied widely. At the Philadelphia city line, on primary route 130 to Media, the average motor traffic per day was 9,114 vehicles, while on route 289 of the secondary system in Lycoming County, the average was but 22 motor vehicles. The maximum traffic at these stations was 25,060 vehicles and 80 vehicles, respectively.

The detailed tabulation of motor vehicle density at the 1,351 traffic survey stations is shown in Appendix II, in which are listed all stations at which data were secured, the numbers of the corresponding routes, the average density of all motor vehicle traffic for a 24-hour day, the average daily density of motor truck traffic, the nor-

mal maximum traffic, and the estimated traffic for 1930.

The average and maximum daily traffic on all primary routes of the State highway system are shown on the map, Figure 5. Either the United States Bureau of Public Roads or the Pennsylvania Department of Highways upon request will furnish a map which shows the average daily total motor vehicle traffic, motor truck traffic, and estimated total traffic in 1930 on each State highway for which traffic data were obtained, together

⁹ In this report certain terms, frequently used, have invariably the same meaning. These terms and their definitions are as follows:

Vehicles refers only to motor vehicles (passenger cars and trucks) exclusive of horse-drawn conveyances.

Traffic is defined as the movement to and fro of vehicles over a highway.

Density of traffic is defined as the number of motor vehicles passing any given point on a highway in a unit of time. Unless a different unit of time is specifically stated density of traffic refers to the number of vehicles passing any given point on a highway during a day of 24 hours.

The accuracy of the determination of density of traffic is influenced by the distance between the survey stations. Exactness of method would require a density record for each point on the highway system where traffic varies. The cost involved in proportion to the relatively small gain in accuracy does not justify location of traffic observation points at close intervals. The density computed for each station on the Pennsylvania highway system is applied to the short sections of highway reasonably adjacent to each station on which there is but little variation in traffic.

In discussions of the utilization of the highway system, where it is desired to discriminate between the use of the highway by vehicles and the volume of traffic, the term *vehicle-miles per mile* is used in the former connection. Numerically, *vehicle-miles per mile* are equivalent to density of traffic.

Vehicle-mile is defined as the movement of a motor vehicle one mile.

Average daily vehicle-miles on the highway system are calculated by multiplying the average daily density of traffic on each section of highway, by the length of each section, and adding the products.

Daily refers to a day of 24 hours.

Average daily refers to an average day during the period of the survey.

Ton-mile is defined as the movement of a ton one mile.

Net tonnage refers to the net weight of the motor truck cargo.

Gross tonnage or *gross load* refers to the weight of the motor truck cargo and vehicle. The gross weight of an empty truck is equal to the weight of the truck.

Foreign traffic represents vehicles having other than Pennsylvania State license tags. Foreign vehicle-miles are calculated by applying the percentage of foreign vehicles at each station to the total vehicle-miles on the sections of highway adjacent to each station and adding to obtain the total foreign vehicle-miles. Similar procedure is used in calculation of farm and city, business and non-business and touring traffic, and trucking for hire.

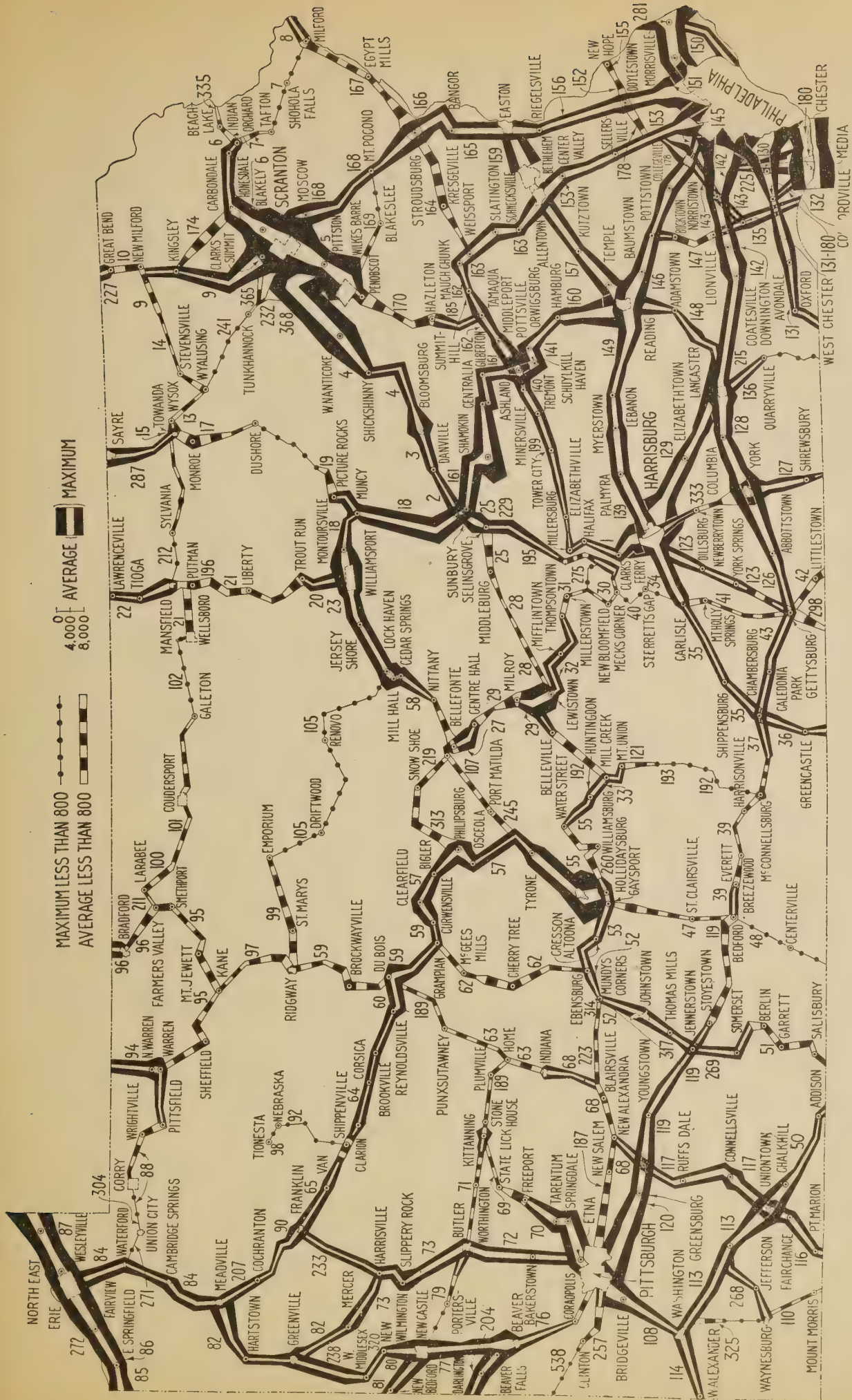


Fig. 5—Map of Pennsylvania showing the average and maximum daily traffic on the Primary Highway System

with the distribution of population. The relative traffic importance of the various routes is clearly indicated by this map; and for purposes of quantitative judgment, the mileage involved is classified in Figure 6 according to several traffic-density classes.

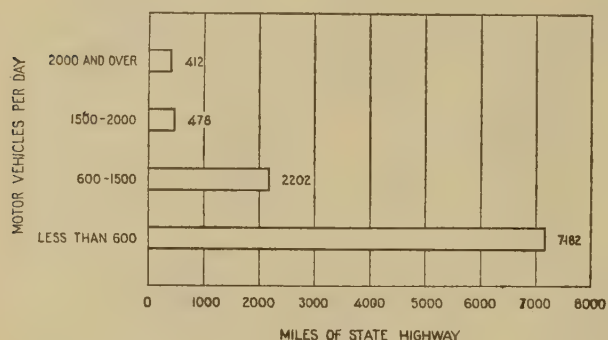


Fig. 6—Mileage of State highways by traffic classes

During the period of the survey there were certain sections of highway under construction, with resulting interference with normal traffic movement. In certain cases, where there was reasonable basis for a corrected estimate, allowance has been made for this fact. Obviously, there is no way of knowing exactly how much traffic there would have been on any given highway had there not been such interference with free vehicle movement.

Upon the basis of traffic there are three separate sections (fig. 7) somewhat comparable with the distribution of population and industry. The most important of these sections lies in the eastern part of the Commonwealth, and includes, in order of traffic density, the counties of Philadelphia,¹⁰ Delaware, Lackawanna, Northampton, Montgomery, Dauphin, Lehigh, Schuylkill, Luzerne, Berks, Bucks, Chester, York, Cumberland, Lancaster, Northumberland, Carbon and Lebanon. This is the area of densest population and of greatest industrial and mining development. It will be

readily seen from the traffic map that it is also the region of heaviest traffic concentration. It included 2,780 miles of State highway, or 27.1 per cent of the entire State system. Of its highways, 300 miles carried a daily traffic of over 2,000 motor vehicles. It is also the most important motor trucking section, where the greatest number of trucks and the greatest percentage of large-capacity trucks operate.

Next in traffic importance is the western section, including the counties of Allegheny, Blair, Erie, Fayette, Lawrence, Washington, Westmoreland, Beaver, Mercer, Butler, Venango, Clearfield, Cambria, Somerset, Crawford, Armstrong, Jefferson, Greene, Indiana and Clarion. Within this area there were 3,313 miles of State highway, 32.2 per cent of the entire State system, of which 103 miles carried a daily average of over 2,000 motor vehicles. A considerable volume of trucking is also to be noted, largely in the vicinity of Pittsburgh.

The wedge-shaped area lying between and north of the two sections just described, and including all the remaining counties is of least traffic importance. Of the 4,181 miles of State highway in this section, 40.7 per cent of the State system, but 9 miles carried a daily average of more than 2,000 vehicles; and only 690 miles carried over 600 vehicles daily.

Table 5 lists, according to these three divisions, the various sections of State highway which carried a daily average traffics of 1,500 motor vehicles or more in 1924. These sections are further classified as to whether they constituted a part of the primary system or the secondary system. The number of trucks of all capacities is shown, together with the number of heavy (3 to 7½-ton) trucks.

¹⁰ There are no State highways in Philadelphia County. The city of Philadelphia and the county are coterminous.

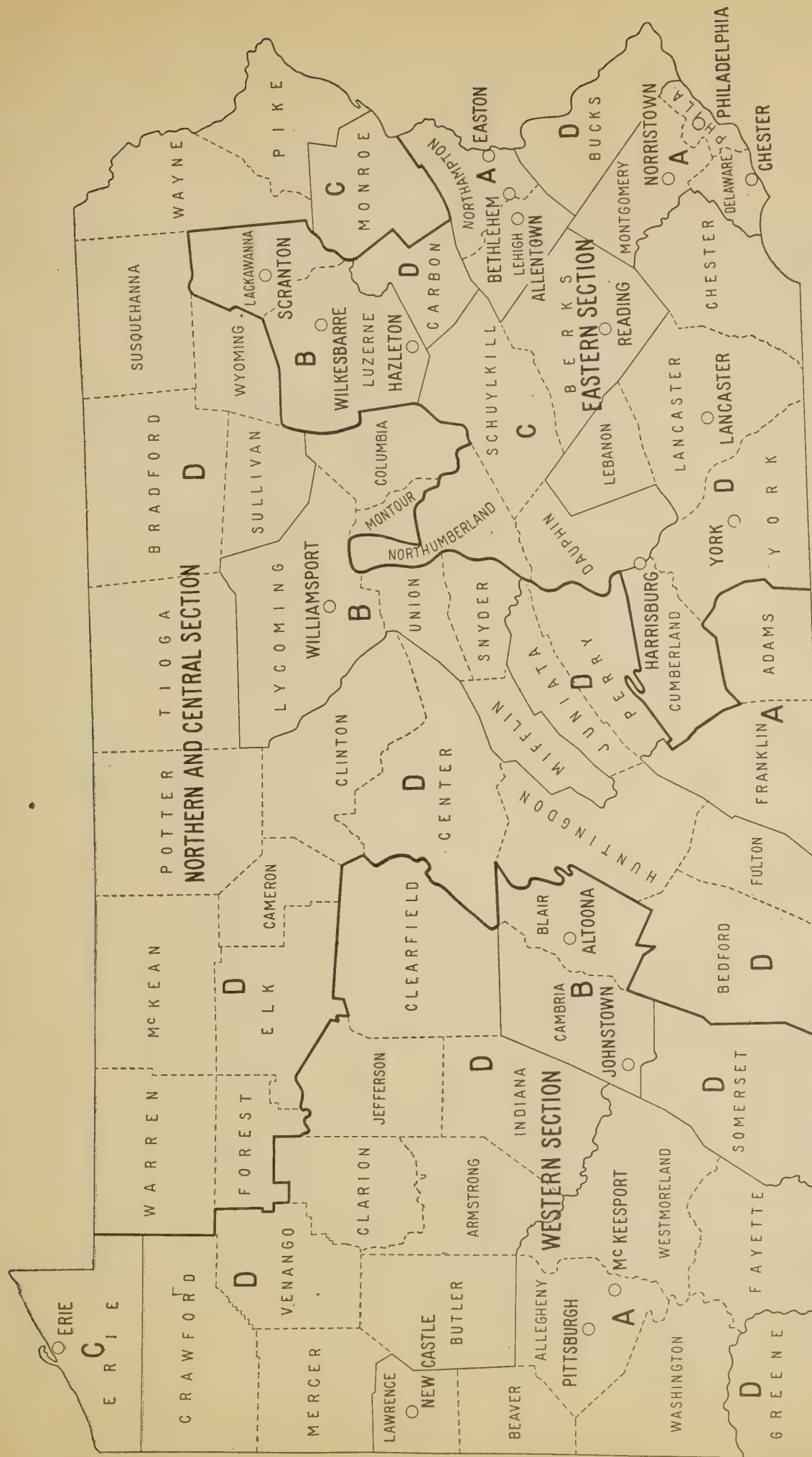


Fig. 7—Map of Pennsylvania showing traffic and population sections and sub-divisions. Traffic sections separated by heavy solid lines, sub-divisions by light solid lines.

Table 5—Sections of the Pennsylvania State highways which carried a daily density of over 1,500 motor vehicles in 1924

Route number	Approximate mileage	Highway section	Primary or secondary	Average daily motor vehicles	Average daily trucks	Average daily 3-7½ ton trucks
EASTERN SECTION						
<i>Philadelphia District</i>						
130	7	Philadelphia—Media	P	7,171	637	175
142	3	Philadelphia—Bryn Mawr	P	6,929	776	198
142	6	Bryn Mawr—Wayne	P	5,407	605	153
151	6	Philadelphia—Willow Grove	P	4,626	472	67
132-180	10	Philadelphia—Chester—Del. Line ..	P	4,522	661	173
281	13	Philadelphia—Morrisville	P	3,744	446	194
142	14	Wayne—Jct. with Route 147	P	3,357	301	103
133	6	Philadelphia—Jct. Routes 133 and 225	S	3,171	276	109
142	12	Jct. with Route 147—Coatesville ..	P	2,545	187	65
153	8	Philadelphia—Springhouse	P	2,507	241	31
151	13	Willow Grove—Doylestown	P	1,954	134	27
131	23	Media—Avondale	P	1,945	181	42
225	13	Chester—Jct. Routes 142 and 225 ..	P	1,762	153	...
178	4	Norristown—Center Square	P	1,665	170	27
146	21	Norristown—Pottstown	P	1,639	190	36
135	10	West Chester—Delaware Line	P	1,525	149	....
<i>Scranton—Wilkes Barre District</i>						
5	17	Wilkes Barre—Scranton	P	4,007	553	87
9	11	Scranton—Factoryville	P	3,002	294	31
4-368	7	Pittston—Wilkes Barre	P	2,994	398	42
6	14	Scranton—Carbondale	P	2,877	466	39
4	18	Shickshinny—Jct. Routes 4 and 368	P	1,950	284	77
168	10	Scranton—Moscow	P	1,802	125	26
<i>Reading District</i>						
149	13	Reading—Womelsdorf	P	3,067	276	46
146	15	Reading—Pottstown	P	2,581	205	40
157	15	Reading—Kutztown	P	2,420	256	55
160	14	Reading—Hamburg	P	1,944	206	26
<i>Allentown—Easton District</i>						
159	6	Allentown—Easton	P	3,066	297	46
157	18	Allentown—Kutztown	P	2,265	148	55
165-166	22	Easton—Stroudsburg	P	1,802	166	10
163	9	Allentown—Schnecksville	P	1,713	169	17
156-151	30	Easton—Doylestown	P	1,602	126	27
<i>Harrisburg District</i>						
129	16	Harrisburg—Elizabethtown	P	2,588	264	41
1	13	Harrisburg—Clarks Ferry	P	2,483	271	128
139	21	Harrisburg—Lebanon	P	1,943	161	27
34	17	Harrisburg—Carlisle	P	1,765	140	15
123	12	Harrisburg—Dillsburg	P	1,538	65	....
<i>York—Lancaster District</i>						
128-126	34	Lancaster—Abbottstown	P	2,322	188	44
129	18	Lancaster—Elizabethtown	P	1,816	124	30
216	9	York—Red Lion	S	1,697	296	53
215-142	27	Lancaster—Coatesville	P	1,656	106	32

Table 5—Sections of the Pennsylvania State highways which carried a daily density of over 1,500 motor vehicles in 1924—Continued

Route number	Approximate mileage	Highway section	Primary or secondary	Average daily motor vehicles	Average daily trucks	Average daily 3-7½ ton trucks
		<i>Sunbury—Pottsville District</i>				
161	15	Sunbury—Shamokin	P	2,391	329	22
140-141	21	Pottsville—Hamburg	P	2,095	228	37
162	6	Pottsville—Middleport	P	1,969	238	....
290	4	Mahanoy City—Gilberton	S	1,837	189	....
25	6	Sunbury—Selinsgrove	P	1,616	120	12
18	28	Sunbury—Muncy	P	1,572	93	9
163	9	Weissport—Mauch Chunk	P	1,529	182	8
Total	644					
		WESTERN SECTION				
		<i>Pittsburgh District</i>				
120	6	Pittsburgh—East Pittsburgh	P	3,272	346	63
108	5	Pittsburgh—Bridgeville	P	3,253	420	64
70	15	Pittsburgh—Springdale	P	2,688	468	88
119-120	28	Youngstown—East Pittsburgh	P	2,134	130	26
247	8	Pittsburgh—Castle Shannon	S	1,942	320	67
108	4	Bridgeville—Washington County Line	P	1,700	219	....
		<i>Erie District</i>				
272	9	Erie—Fairview	P	2,441	171	12
87	14	Erie—New York Line	P	2,390	120	8
86	14	Fairview—Ohio Line	P	1,718	94	7
		<i>Altoona District</i>				
55	4	Altoona—Hollidaysburg	P	3,330	268	55
55	15	Altoona—Tyrone	P	1,726	117	10
113-50	17	Brownsville—Uniontown—Summit	P	2,410	181	21
116	5	Uniontown—Fair Chance	P	2,067	217	25
57	7	Philipsburg—Osceola	P	1,877	161	9
91	6	Oil City—Franklin	S	1,804	114	10
117	28	Uniontown—Greensburg	P	1,675	132	12
74	14	Mercer—Ohio Line	S	1,629	99	7
77	24	Newcastle—Beaver	P	1,504	96	26
Total	223					
		NORTHERN AND CENTRAL SECTION				
58	3	Lock Haven—Mill Hall	P	2,131	259	....
29	6	Lewistown—Reedsville	P	2,097	212	38
94	2	Warren—North Warren	P	1,886	132	17
18	12	Williamsport—Muncy	P	1,844	153	10
Total	23					
Grand Total	890					

It will be seen from this table that practically all the routes carrying heavy traffic are adjacent to or connect the larger cities. Of the 644 miles of highway in the eastern section carrying over 1,500 vehicles daily, 169 miles are in the Philadelphia area, 77 miles in the Scranton-Wilkes-Barre area, 57 adjacent to Reading, 85 in the Allentown-Easton area, 79 adjacent to Harrisburg, 88 in the Lancaster-York area and 89 in the Sunbury-Pottsville area. In the western division, 66 miles radiate out of Pittsburgh, 37 miles make up the important interstate route through Erie, and the remaining sections are adjacent to other important cities.

The predominance of the southeastern section is indicated by the fact that 72 per cent of the mileage which carried more than 1,500 vehicles per day is in this area. The western section includes 25 per cent of the State mileage which carried over 1,500 vehicles per day. In Allegheny

county of the western section several important traffic routes are not included in the State highway system. The northern and central section had a very low average density of traffic, only 23 miles carried over 1,500 vehicles daily.

It should also be noted that but 47 miles of the total mileage listed is on the secondary system.

The sections of highway listed in Table 5 are all to be regarded as important routes. Of almost equal significance for present and future planning, construction, and maintenance is the mileage of highways with traffic ranging between 600 and 1,500 motor vehicles per day. These sections are not so uniformly improved as are those of larger traffic density, yet the traffic which they must carry is rapidly increasing, and requires adequate improvement of the roads. Sections which carried traffic of from 600 to 1,500 vehicles in 1924 are listed in Table 6. This table also shows the estimated traffic density in 1930.

Table 6—Sections of the Pennsylvania State highways which carried a daily density of from 600 to 1,500 motor vehicles in 1924

Route number	Approximate mileage	Highway section	Primary or secondary	Average daily motor vehicles	Average daily trucks	Average motor daily vehicles
						1930
EASTERN SECTION						
<i>Philadelphia District</i>						
145	8	Philadelphia—Norristown	P	1,116	131	1,910
131	17	Avondale—Maryland line	P	1,086	66	1,760
150	17	Philadelphia—Morrisville	P	1,085	148	1,780
133	14	West Chester—Jct. Routes of 133 and 225	S	1,055	100	1,710
147	22	West Chester—Pottstown	P	1,027	107	1,740
155	14	Centerville—Willow Grove	S	999	74	1,690
143	11	Norristown—Malvern	P	976	121	1,650
201	16	Philadelphia—Valley Forge	S	964	79	1,630
143	7	West Chester—Malvern	P	933	116	1,510
180	5	Chester—Jct. Routes 131 & 180 ..	P	916	112	1,700
197	14	Philadelphia—Center Square	S	776	69	1,330
178	13	Center Square—Doylestown	P	661	64	1,100
155	7	New Hope—Centerville—Doylestown	P	635	52	1,040
<i>Scranton—Wilkes Barre District</i>						
170	5	Wilkes Barre—Penobscot	P	1,042	96	1,760
232	15	Pittston—Exeter	P	886	75	1,490
<i>Reading District</i>						
148	11	Reading—Adamstown	P	1,401	212	2,320
149	14	Womelsdorf—Lebanon	P	1,390	129	2,280

Table 6—Sections of the Pennsylvania State highways which carried a daily density of from 600 to 1,500 motor vehicles in 1924—Continued

Route number	Approximate mileage	Highway section	Primary or secondary	Average daily motor vehicles	Average daily trucks	Average daily motor vehicles
		<i>Allentown—Easton District</i>				1930
163	14	Schnecksville—Weissport	P	1,297	122	2,280
153	33	Allentown—Springhouse	P	1,268	142	2,130
165-166	32	Easton—Stroudsburg (via secondary routes)	S	1,000	97	1,710
		<i>Harrisburg District</i>				
250-333	22	Harrisburg—York	P	1,490	134	2,430
35	33	Carlisle—Chambersburg	P	1,052	72	1,710
370	5	Harrisburg—Paxtonia	S	981	96	1,640
1	14	Clarks Ferry—Millersburg	P	756	82	1,270
41	7	Mt. Holly Springs—Carlisle	P	664	56	1,090
199	14	Millersburg—Lykens	P	602	59	1,010
		<i>York—Lancaster District</i>				
127	17	York—Maryland line	P	1,426	142	2,320
124	20	York—Dover—Dillsburg	S	1,158	115	1,880
148	20	Adamstown—Ephrata—Lancaster ..	P	1,125	92	1,850
136	13	Lancaster—Quarryville	P	986	101	1,600
230	14	Hanover—Spring Grove—Jct. of Routes 126 and 230	S	855	84	1,390
137	30	Ephrata—Blue Ball—Downingtown	S	686	41	1,110
		<i>Sunbury—Pottsville District</i>				
161	21	Shamokin—Gilberton	P	1,480	197	2,430
199	20	Pottsville—Tower City	P	1,443	208	2,500
162	16	Summit Hill—Middleport	P	1,290	156	2,090
161	9	Gilberton—Pottsville	P	1,223	142	1,980
162	8	Mauch Chunk—Summit Hill	P	1,099	153	1,880
185	10	Hazleton—Tamaqua	P	970	100	1,600
199	10	Tower City—Lykens	P	902	91	1,570
190	9	Hometown—Mahanoy City	S	803	83	1,300
170	5	Hazleton—Drums	P	765	93	1,290
Total	606	WESTERN SECTION				
		<i>Pittsburgh District</i>				
72-73	32	Bakerstown—Butler—Slippery Rock	P	1,469	68	2,390
108	13	Washington—Allegheny County line	P	1,065	79	1,900
72	12	Pittsburgh—Bakerstown	P	1,377	159	2,340
246	23	Pittsburgh—Jct. of Routes 78 and 347	S	1,254	114	2,130
		<i>Erie District</i>				
84	34	Erie—Meadville	P	1,170	63	2,050
		<i>Altoona District</i>				
222	17	Johnstown—Scalp Level—Oglestown	S	1,174	89	1,350
269-317	25	Somerset—Johnstown	P	1,142	84	1,980
52	17	Johnstown—Ebensburg	P	1,109	101	1,910
53-276	22	Ebensburg—Hollidaysburg	P	1,094	81	1,880
260	14	Williamsburg—Hollidaysburg	P	755	99	1,290

Table 6—Sections of the Pennsylvania State highways which carried a daily density of from 600 to 1,500 motor vehicles in 1924—Continued

Route number	Approximate mileage	Highway section	Primary or secondary	Average daily motor vehicles	Average daily trucks	Average daily motor vehicles
						1930
80	8	Newcastle—New Wilmington	P	1,465	117	2,550
113	23	Washington—Brownsville	P	1,441	81	2,570
118	6	Bentleyville—Jct. of Routes 118 & 247	S	1,431	214	2,560
233	16	Newcastle—Slippery Rock	S	1,413	123	2,460
81	12	Newcastle—Ohio line	P	1,388	95	2,410
70	11	Springdale—Butler County line	P	1,387	242	2,360
114	16	Washington—West Alexander	P	1,374	75	2,450
116	12	Fair Chance—West Virginia line . . .	P	1,364	143	2,290
204	14	Beaver—Ohio line	P	1,364	101	2,490
205	13	Titusville—Oil City	S	1,334	178	2,160
82	7	Conneaut Lake—Meadville	P	1,289	34	2,200
59	7	Clearfield—Curwensville	P	1,265	102	2,100
119	21	Jennerstown—Youngstown	P	1,261	75	2,170
59	17	Du Bois—Curwensville	P	1,220	97	2,030
57	16	Clearfield—Philipsburg	P	1,193	91	1,980
68	6	Homer City—Indiana	P	1,182	94	2,050
315	13	Newcastle—Elwood City	S	1,112	82	1,930
247	40	Connellsville—Star Jct.—Castle Shannon	S	1,111	126	1,910
73	8	Slippery Rock—Harrisville	P	1,101	50	1,790
189	5	Kittanning—Stone House	P	1,084	106	1,800
68	8	Greensburg—New Alexandria	P	1,066	120	1,830
82	20	Greenville—Conneaut Lake	P	1,057	27	1,800
69	12	Greensburg—Mamont	S	1,052	58	1,800
238-320	12	Greenville—New Wilmington	P	1,037	55	1,790
50	23	Summit—Maryland line	P	1,010	26	1,720
268	21	Brownsville—Waynesburg	P	964	104	1,610
60	21	Brookville—DuBois	P	955	61	1,520
313	7	Philipsburg—Kylertown	P	946	95	1,540
69-188	17	North Washington—Jct. of routes 70 & 188	S	908	72	1,560
82	15	Mercer—Greenville	P	881	31	1,540
218-233	20	Harrisville—Franklin	P	877	29	1,420
49-51	10	Somerset—Berlin	P	872	52	1,510
90-207	24	Meadville—Franklin	P	870	46	1,390
119	37	Bedford—Jennerstown	P	854	48	1,470
64	18	Clarion—Brookville	P	853	40	1,330
68	13	Blairsville—Homer City	P	831	65	1,440
71	8	Kittanning—Worthington	P	825	48	1,380
214	13	Butler—Karns City	S	806	43	1,310
79	15	Butler—Portersville	P	726	83	1,540
78	31	Beaver—Evansburg—Butler	S	722	50	1,240
65	26	Franklin—Clarion	P	683	41	1,210
76	19	Beaver—Coraopolis	P	682	62	1,210
187	19	New Salem—Jct. of routes 120 & 187	P	672	76	1,150
118	16	Greensburg—West Newton	S	662	45	1,140
51	18	Berlin—Garrett—Salisbury	P	659	47	1,140
309	9	Evansburg—Valencia	S	630	57	1,020
89	8	Plum—Titusville	S	617	40	960
Total	929	NORTHERN AND CENTRAL SECTION				
27	8	Center Hall—Bellefonte	P	1,454	83	2,320
23	22	Lock Haven—Williamsport	P	1,421	115	2,290
9	19	Factoryville—Kingsley	P	1,420	132	2,410

Table 6—Sections of the Pennsylvania State highways which carried a daily density of from 600 to 1,500 motor vehicles in 1924—Continued

Route number	Approximate mileage	Highway section	Primary or secondary	Average daily motor vehicles	Average daily trucks	Average daily motor vehicles
						1930
43	24	Gettysburg—Chambersburg	P	1,313	77	2,100
96	2	Bradford—New York line	P	1,290	72	2,050
168	38	Moscow—Stroudsburg	P	1,266	104	2,070
19	10	Muncy—Picture Rocks	P	1,263	109	2,030
55-33	14	Water Street—Huntingdon—Mill Creek	P	1,190	92	2,010
4	23	Bloomsburg—Briar Creek—Shick-shinny	P	1,165	126	1,980
126	13	Abbottstown—Gettysburg	P	1,129	55	1,790
167	5	Stroudsburg—Jct. of routes 167 & 220	P	1,088	104	1,770
20	11	Trout Run—Williamsport	P	1,084	77	1,740
36	16	Chambersburg—Maryland line	P	1,066	78	1,710
57	18	Osceola—Tyrone	P	1,056	56	1,810
196	4	Mansfield—Putman	P	1,030	68	1,740
56	7	State College—Pleasant Gap	S	1,016	95	1,620
88	7	Warren—Irvineton	P	976	79	1,540
195-225	35	Selinsgrove—Clarks Ferry	P	965	54	1,630
107	2	Bellefonte—Milesburg	P	961	90	1,530
6-7	20	Carbondale—Honesdale—Indian Orchard	P	944	108	1,460
2-3	21	Sunbury—Danville—Bloomsburg ..	P	926	61	1,650
12-287	19	Towanda—Sayre	P	926	60	1,420
37	20	Chambersburg—McConnellsburg ..	P	916	73	1,490
17	4	Towanda—Monroe	P	910	64	1,400
97	5	Bradford—Lewis Run	S	884	78	1,410
15	3	Towanda—Wysox	P	880	82	1,350
33	4	Mill Creek—Mt. Union	P	863	72	1,390
55	10	Tyrone—Water Street	S	861	61	1,420
31-32	21	Thompstontown—Mifflintown—Lew-istown	P	851	60	1,360
8	7	Milford—New Jersey line	P	851	52	1,180
123	23	Dillsburg—Gettysburg	P	845	35	1,340
107-245	27	Milesburg—Jct. of routes 57 & 245 ..	P	837	50	1,510
22-196	16	Lawrenceville—Mansfield	P	823	44	1,340
58	24	Bellefonte—Mill Hall	P	801	83	1,290
192	24	Reedsville—Mill Creek	P	739	63	1,250
21	14	Wellsboro—Putman	P	729	43	1,180
9-10-227	18	Kingsley—New York line	P	692	54	1,180
174	29	Carbondale—Kingsley	P	687	98	1,120
42	12	Gettysburg—Littlestown—Maryland line	P	675	81	1,070
164	22	Stroudsburg—Kresgeville	P	666	95	1,360
230	7	Littlestown—Hanover	S	666	65	1,070
298	8	Gettysburg—Maryland line	P	666	32	1,060
39	31	McConnellsburg—Bedford	P	659	52	1,120
Total	667					
Grand Total	2,202					

Of the State highway mileage carrying between 600 and 1,500 motor vehicles per day, the eastern section had 28 per cent. the western section 42 per cent. and the northern and central section 30 per cent. Of the total mileage which carried over 600 vehicles per day, 1,250 miles, or 40 per cent,

were located in the eastern section, 1,152 miles, or 37 per cent in the western section and 690 miles, or 23 per cent in the northern and central section. This group includes 45 per cent of the total State highway mileage in the eastern section, 35 per cent in the western section and 16 per cent in the northern and central section. The estimate of traffic in 1930 indicates that by that date there will be approximately 1,404 miles of highway added to the 890 miles which carried over 1,500 vehicles daily in 1924. Of the total mileage expected to carry over 1,500 vehicles in 1930, 49 per cent will be in the eastern, 36 per cent in

the western, and 15 per cent in the northern and central section.

The greatest density of traffic is found in the immediate vicinity of the larger cities and on the principal through routes. The concentration of traffic about these centers of population is evident from the traffic map. The principal through routes are also evident as broad bands crossing the Commonwealth and, in general, connecting the important cities. The average daily and maximum daily traffic on State routes near the gateways to the larger cities are shown in Tables 7 to 14.

Table 7—Daily density of traffic on State highways near city limits of principal cities in 1924

City	Number of roads	Average daily number of vehicles			Maximum daily total vehicles
		Motor trucks	Passenger cars	Total vehicles	
Philadelphia	13	4,938	42,034	46,972	123,490
Pittsburgh	9	2,491	17,220	19,711	52,760
Scranton	5	1,762	12,226	13,988	52,460
Reading	8	1,844	16,495	18,339	50,420
Erie	6	747	9,345	10,092	37,340
Harrisburg	6	2,424	19,710	22,134	57,080
Wilkes-Barre	6	1,903	13,428	15,331	55,660

Table 8—Daily density of traffic on State highways near city limits of Philadelphia in 1924

Route	Station	Distance from station to city line	Average daily number of vehicles			Maximum daily total vehicles
			Motor trucks	Passenger cars	Total vehicles	
		<i>Miles</i>				
130	726	$\frac{1}{2}$	811	8,303	9,114	25,060
142	1,050	$2\frac{3}{4}$	776	6,153	6,929	19,060
151	1,057	1	694	6,108	6,802	18,710
133	36	$\frac{1}{2}$	536	5,632	6,168	13,020
180	738	$\frac{1}{2}$	767	3,998	4,765	13,100
281	124	$\frac{1}{2}$	336	3,273	3,609	8,180
153	1,060	$1\frac{1}{2}$	341	3,210	3,551	9,760
145	1,052	1	169	1,277	1,446	3,980
150	117	1	193	1,074	1,267	3,480
197 }	274	$1\frac{1}{2}$	110	900	1,010	2,780
373 }						
201	1,078	$\frac{1}{2}$	68	836	904	2,490
362	1,088	$2\frac{1}{2}$	80	740	820	2,260
198	1,077	1	57	530	587	1,610
Total .....	.....	.....	4,938	42,034	46,972	123,490

*Susquehanna Trail in Tioga County***Table 9—Daily density of traffic on State highways near city limits of Pittsburgh in 1924**

Route	Station	Distance from station to city line	Average daily number of vehicles			Maximum daily total vehicles
			Motor trucks	Passenger cars	Total vehicles	
		<i>Miles</i>				
120	88	$\frac{1}{2}$	417	3,432	3,849	9,920
108	387	$2\frac{1}{2}$	472	3,187	3,659	9,880
246	390	$\frac{1}{2}$	274	2,739	3,013	8,140
70	381	$2\frac{1}{2}$	478	2,271	2,749	7,420
247	7	$\frac{1}{2}$	320	1,622	1,942	5,240
228	5	3	234	1,498	1,732	4,680
72	2	5	166	1,270	1,436	3,880
257	394	$3\frac{1}{2}$	91	815	906	2,450
76	385	$1\frac{1}{2}$	39	386	425	1,150
Total .....	.....	.....	2,491	17,220	19,711	52,760

Table 10—Daily density of traffic on State highways near city limits of Scranton in 1924

Route	Station	Distance from station to city line	Average daily number of vehicles			Maximum daily total vehicles
			Motor trucks	Passenger cars	Total vehicles	
		<i>Miles</i>				
5	852	1	719	4,454	5,173	19,400
6	853	4½	585	3,025	3,610	13,500
9	856	½	275	2,535	2,810	10,540
168	50	7½	140	1,884	2,024	7,590
335	860	10	43	328	371	1,390
Total			1,762	12,226	13,988	52,460

Table 11—Daily density of traffic on State highways near city limits of Reading in 1924

Route	Station	Distance from station to city line	Average daily number of vehicles			Maximum daily total vehicles
			Motor trucks	Passenger cars	Total vehicles	
		<i>Miles</i>				
157	431	½	416	3,513	3,929	10,800
146	420	½	219	3,157	3,376	9,280
149	430	½	281	2,837	3,118	8,570
160	434	½	329	2,771	3,100	8,520
148	427	½	349	1,960	2,309	6,350
147	423	1½	89	823	912	2,510
310	451	½	83	716	799	2,200
274	444	1	78	718	796	2,190
Total			1,844	16,495	18,339	50,420

Table 12—Daily density of traffic on State highways near city limits of Erie in 1924

Route	Station	Distance from station to city line	Average daily number of vehicles			Maximum daily total vehicles
			Motor trucks	Passenger cars	Total vehicles	
		<i>Miles</i>				
87	39	1¾	180	2,380	2,560	9,470
272	765	5	171	2,270	2,441	9,030
86	755	1	155	2,064	2,219	8,210
84	754	½	108	1,475	1,583	5,860
258	187	½	50	640	690	2,550
88	762	½	83	516	599	2,220
Total			747	9,345	10,092	37,340

Table 13—Daily density of traffic on State highways near city limits of Harrisburg in 1924

Route	Station	Distance from station to city line	Average daily number of vehicles			Maximum total vehicles
			Motor trucks	Passenger cars	Total vehicles	
		<i>Miles</i>				
34	30	1	908	6,926	7,834	17,740
129	709	$\frac{1}{2}$	452	3,699	4,151	11,420
1	703	$\frac{1}{2}$	349	2,854	3,203	8,810
30	683	$1\frac{1}{2}$	309	2,035	2,344	6,450
140	717	$1\frac{1}{4}$	230	2,112	2,342	6,440
139	712	$\frac{1}{2}$	176	2,084	2,260	6,220
Total			2,424	19,710	22,134	57,080

Table 14—Daily density of traffic on State highways near city limits of Wilkes-Barre in 1924

Route	Station	Distance from station to city line	Average daily number of vehicles			Maximum daily total vehicles
			Motor trucks	Passenger cars	Total vehicles	
		<i>Miles</i>				
5	951	$\frac{1}{2}$	545	3,375	3,920	14,700
11	953	4	391	2,784	3,175	11,910
368	58	3	378	2,743	3,121	9,870
4	950	6	419	2,448	2,867	10,750
169	955	$\frac{3}{4}$	74	1,131	1,205	4,520
170	958	$\frac{1}{2}$	96	947	1,043	3,910
Total			1,903	13,428	15,331	55,660

These data represent the average and maximum daily traffic recorded at traffic survey stations near the city gateways. In several cases the stations were located at some distance from the city and the totals as shown do not represent the actual total number of vehicles entering or leaving the city but are indicative of the importance of these cities as sources of traffic on the State highways.

On thirteen of the State highways serving Philadelphia, there was a daily average traffic of 46,972 motor vehicles, of which 5,000 were motor trucks. On the maximum traffic day 123,490 motor vehicles used these same highways.

On nine of the State routes serving Pittsburgh,

there were 19,711 motor vehicles daily, with a maximum traffic on these same highways of 52,760 motor vehicles. The county highways radiating from Pittsburgh also carry a large daily volume of traffic.

The more important through traffic routes carry distinctive names and markers in addition to the official route numbers. Among these are the Lincoln Highway, the Susquehanna Trail, the Lakes-to-Sea Highway, the Lackawanna Trail, the William Penn Highway and the Roosevelt Highway. The density of traffic on different sections of these highways is shown in the following tabulation.

HIGHWAY TRANSPORTATION SURVEY

Lincoln Highway

Section	Approximate mileage	Average daily density of motor vehicles in 1924
Morrisville—Philadelphia ..	13	3,357
Philadelphia—Wayne	9	5,914
Wayne—Coatesville	26	2,982
Coatesville—York	47	1,939
York—Gettysburg	27	1,487
Gettysburg—Chambersburg ..	24	1,313
Chambersburg—McConnellsburg	20	916
McConnellsburg—Bedford ..	31	659
Bedford—Jennerstown	37	854
Jennerstown—Greensburg ..	30	1,556
Greensburg—Pittsburgh ..	23	2,699

Susquehanna Trail

Lawrenceville—Trout Run ..	53	729
Trout Run—Williamsport ..	11	1,084
Williamsport—Muncy	13	1,844
Muncy—Sunbury	27	1,572
Sunbury—Clarks Ferry	40	1,104
Clarks Ferry—Harrisburg ..	13	2,483
Harrisburg—York	22	1,490
York—Maryland State line ..	17	1,426

Lakes-to-Sea Highway

Erie—Meadville	34	1,170
Meadville—Franklin	24	870
Franklin—Clarion	26	683
Clarion—Brookville	18	853
Brookville—Du Bois	21	955
Du Bois—Clearfield	24	1,220
Clearfield—Philipsburg	16	1,193
Philipsburg—Osceola	7	1,877
Osceola—Tyrone	18	1,056
Tyrone—Water Street	10	861

Lackawanna Trail

Great Bend—Kingsley	18	692
Kingsley—Factoryville	19	1,420
Factoryville—Scranton	11	3,002
Scranton—Stroudsburg	47	1,407
Stroudsburg—Easton	22	1,802
Easton—Willow Grove	43	1,662
Willow Grove—Philadelphia ..	6	4,626

William Penn Highway

Easton—Allentown	6	3,066
Allentown—Reading	33	2,321
Reading—Womelsdorf	13	3,067
Womelsdorf—Lebanon	14	1,390
Lebanon—Harrisburg	21	1,943
Harrisburg—Clarks Ferry ..	13	2,483
Clarks Ferry—Lewistown ..	46	798
Lewistown—Reedsville	6	2,097
Reedsville—Mill Creek	24	739
Mill Creek—Water Street ..	14	1,190
Water Street—Hollidaysburg ..	23	755
Hollidaysburg—Mundy's Corners	29	1,090
Mundy's Corners—Pittsburgh ..	60	532 ¹

Roosevelt Highway

Section	Approximate mileage	Average daily density of motor vehicles in 1924
Port Jervis—Milford	7	851
Milford—Indian Orchard ..	30	244 ¹
Indian Orchard—Carbondale ..	20	944
Carbondale—Scranton	14	2,877
Scranton—Jct. of routes 9 & 365	3	3,002
Junction of routes 9 & 365 to Tunkhannock	16	579
Tunkhannock—Wyalusing—Wysox	41	172 ¹
Wysox—Towanda	3	880
Towanda—Mansfield	36	227
Mansfield—Wellsboro	17	729
Wellsboro—Larabee	75	343
Larabee—Warren	60	473
Warren—Corry	31	192 ¹
Corry—Waterford	18	212 ¹
Waterford—Erie	12	1,292

¹Traffic influenced by construction activities during period of survey.



Lakes-to-Sea Highway Near Erie

The wide variation in density of traffic on the different sections of these routes, and the rapid decrease in traffic with distance from centers of population indicates that even on these "through" routes the major part of the traffic is local in character. This is evident from the traffic on the Lincoln Highway between Chambersburg and Jennerstown as compared with the traffic on the

other sections of the route; from the traffic on the northern sections of the Susquehanna and Lackawanna Trails as compared with the other sections

of these routes; and from the traffic on all sections of the Roosevelt Highway except in the vicinity of Scranton.

THE DENSITY OF MOTOR TRUCK TRAFFIC

Motor truck traffic, on the primary highway system¹¹ constituted 8.9 per cent of total motor vehicle traffic measured in vehicle-miles. The ratio of truck traffic to total traffic, however, varied considerably on different routes. On the routes located in important industrial or mining areas, the ratio of truck traffic to total traffic was high. On those in important pleasure-resort areas, and those which form the principal approaches to these areas, truck traffic was small in proportion to total traffic. The ratio of truck traffic to total traffic on the routes in Table 15 indicates these variations.

¹¹ The primary system is used in this discussion because it includes the important highways. Areas containing the heavy-trucking routes of the primary system contain the important routes of the secondary system. The volume of truck traffic is considerably less on the secondary system.



William Penn Highway Near Mill Creek

Table 15—Ratio of truck traffic to total traffic on selected routes of the primary system in 1924

Route		Average daily traffic		Ratio of truck traffic to total traffic
Number	Description	Total	Trucks	
				Per cent
70	Pittsburgh—Springdale	2,688	468	17.4
5-6	Wilkes-Barre—Scranton—Carbon- dale	3,497	514	14.7
132-180	Philadelphia—Chester—Delaware line	4,522	661	14.6
4	Wilkes-Barre—Shickshinney	1,950	284	14.6
150	Philadelphia—Bristol—Trenton ...	1,085	148	13.6
43-126	Gettysburg—Chambersburg	1,313	77	5.9
82-84	Erie—Conneaut Lake	1,190	58	4.9
123	Harrisburg—Gettysburg	1,083	45	4.2
50	Summit—Maryland line	1,010	26	2.6

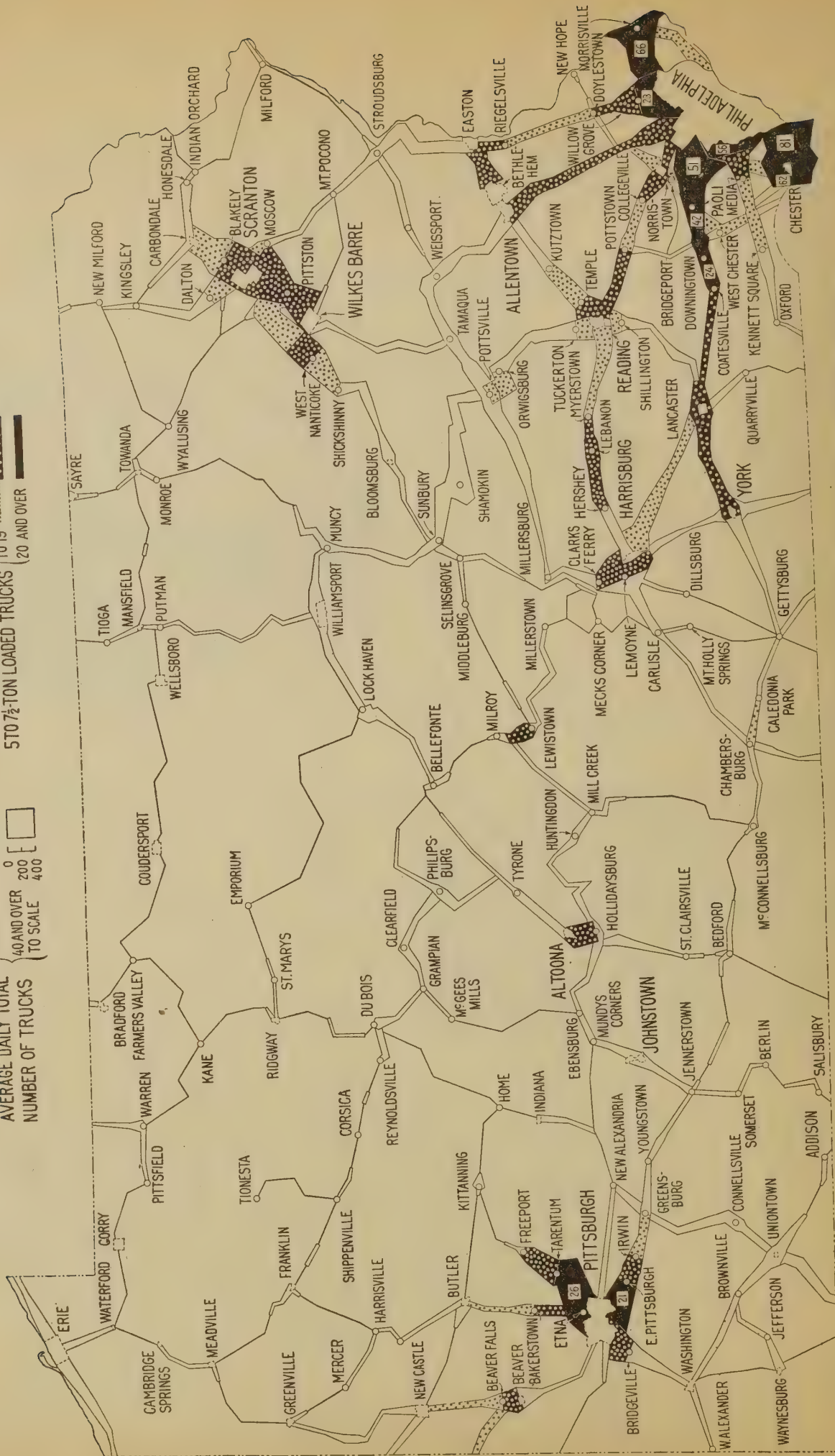
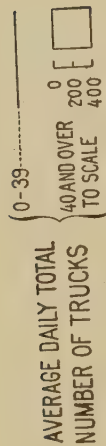
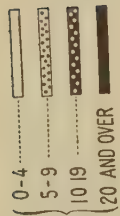
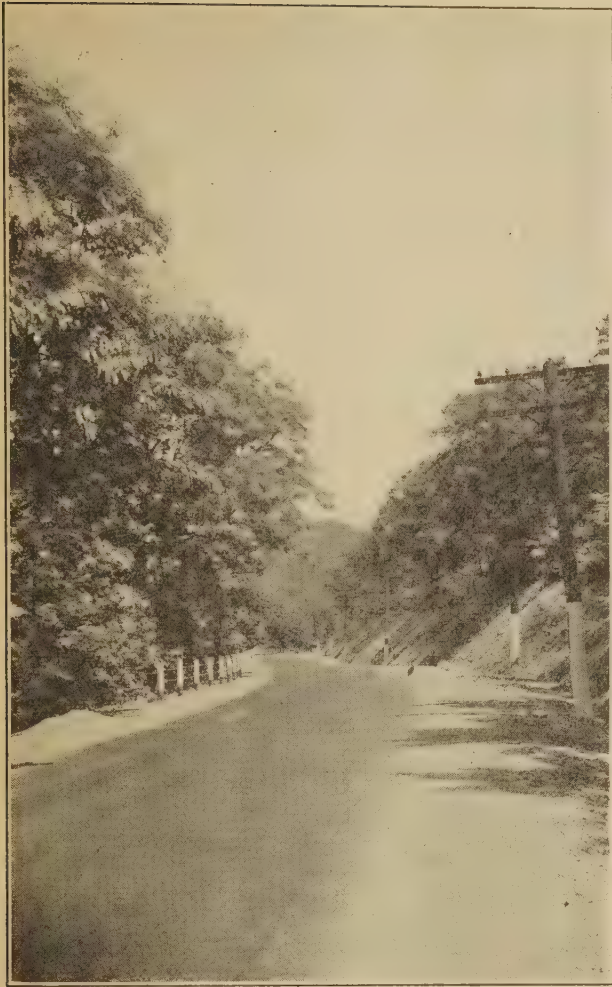


Fig. 8—Map of Pennsylvania showing average daily density of motor truck traffic on the Primary Highway System



Lincoln Highway on the East Side of Tuscarora Mountain

Motor truck traffic on the primary highway system is shown in Figure 8.¹² The density of motor truck traffic on the primary system varied from 10 trucks per day on several unimportant sections to 908 trucks per day on Route 34 between Harrisburg and Lemoyne and 661 trucks per day between Philadelphia and the Delaware line on Route 132-180. As indicated by Table 16, and Figure 9, approximately 60 per cent of the mileage of the primary system carried less than 100 trucks per day and 9.5 per cent carried 200 or more trucks per day.

¹² For density of loaded and empty trucks by capacity classes at transport survey stations see Appendix III.

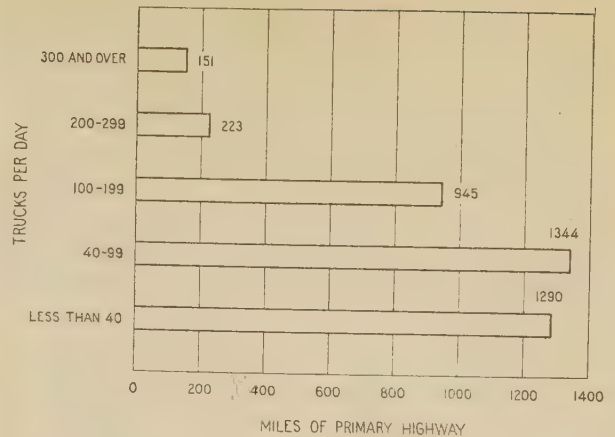


Fig. 9—Mileage of primary highways by truck traffic classes

Table 16—Mileage of primary highways carrying various numbers of motor trucks per day

Average daily truck traffic	Mileage of the primary system	
	Miles	Per cent
Less than 40	1,290	32.6
40-99	1,344	34.0
100-199	945	23.9
200-299	223	5.7
300 & over	151	3.8
Total	3,953	100.0



Roosevelt Highway Near Coudersport

The sections of the primary system on which the density of motor truck traffic in 1924 was more than 200 per day are shown in Appendix IV.

The eastern section shows its predominant importance in truck traffic as well as in total traffic. Half of the routes (Appendix IV) carrying more than 400 trucks per day are located in the Philadelphia territory, two in the Scranton and Wilkes-Barre territory, and one in the Harrisburg territory.

Although the highest density of motor truck traffic was found on route 34 between Harrisburg and Lemoyne, the comparative importance of this section is considerably lessened by the fact that its length is only one mile. Two routes out of Philadelphia, No. 132-180, to the Delaware line via Chester, and No. 130, to Media, were next

in importance and carried on an average day 661 and 637 trucks respectively. The other three routes out of Philadelphia which carried over 400 trucks per day were route 151 to Willow Grove, route 281 to Morrisville and route 142 to Coatesville. The combined length of these five important trucking routes in the Philadelphia area is 71 miles.

In the Scranton and Wilkes-Barre area there are two routes, aggregating 31 miles, on which the truck traffic exceeded 400 trucks per day. These routes are No. 5 from Scranton to Wilkes-Barre and No. 6 from Scranton to Carbondale.

In the Pittsburgh area, route 70, Pittsburgh to Springdale, and route 108, Pittsburgh to Bridgeville, carried 468 and 420 trucks per day respectively.

LOADED 5 TO 7½ TON TRUCK TRAFFIC

Small, light trucks operate on all sections of the State highway system although they occur in varying numbers upon different routes. The larger-capacity trucks, especially those of 5-ton or greater capacity, do not operate on all highways, their use being restricted to certain limited areas. This is indicated by Figure 8 which, by symbols within the traffic bands, shows loaded 5 to 7½-ton truck traffic on the primary system.¹³ There must be a sufficient volume of tonnage to require such vehicles or some special group of commodities requiring a large-capacity vehicle before any noticeable number of large-capacity trucks operate. The larger the total truck movement in an area, the greater is the probability that a considerable number of large-capacity trucks and heavy loads will be found on the highways. The use of all trucks, in respect to number and size, depends upon the amount and type of commodities hauled and, consequently, upon the population and industries of the area served. It is not surprising, therefore, that the greatest movement of loaded 5 to 7½-ton trucks was found in the territory adjacent to Philadelphia, Pittsburgh, Scranton, Wilkes-Barre, and other large cities.

The mileage of the primary system is classified in Table 17 and Figure 10 according to the density of loaded 5 to 7½-ton truck traffic.

Table 17.—Mileage of the primary highways carrying various numbers of loaded 5 to 7½-ton trucks per day in 1924.

Daily loaded 5 to 7½-ton truck traffic	Mileage of the primary system	
	Miles	Per cent
Less than 5	3,309	83.7
5-9	286	7.2
10-19	268	6.8
20 and over	90	2.3
Total	3,953	100.0

On 83.7 per cent of the primary-system mileage there was a density of less than 5 loaded 5 to 7½-ton trucks. There were 644 miles, 16.3 per cent of the mileage of the primary system, on which the density of these trucks exceeded 5 per day. The routes included in these 644 miles are shown in Appendix V.

¹³ For density of loaded 5 to 7½-ton trucks at transport survey stations see Appendix III.

CONCENTRATION OF TRUCK TRAFFIC AROUND THE LARGE CITIES

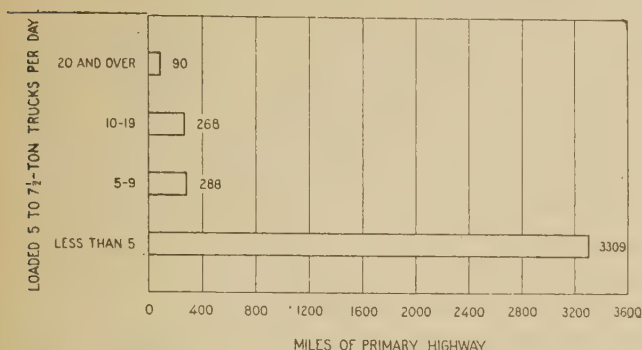


Fig. 10—Mileage of primary highways carrying various numbers of loaded five to seven and one-half ton trucks daily

The most important trucking area from the standpoint of total truck traffic and large-capacity truck traffic, is in southeastern Pennsylvania, especially the territory immediately adjacent to the City of Philadelphia. The important routes serving Philadelphia, in order of the density of their total motor truck traffic, are given in Table 18.

The arrangement of the routes (Table 18) indicates the total motor truck traffic importance of each route near Philadelphia. It will be seen that the total truck traffic on a route does not indicate clearly the importance of the route as a carrier of large-capacity trucks. For example, route 180 to Chester carried 190 trucks of 3 to 7½-ton capacity and 81 loaded 5 to 7½-ton trucks and is,

for this reason, a more important trucking route than route 142 to Paoli, which carried a greater total truck traffic but a lesser traffic of large-capacity trucks.

It will be noted that routes 281 and 151, to Trenton and Willow Grove, respectively, also had approximately the same density of total truck traffic. The route to Trenton, however, carried 141 trucks of 3 to 7½-ton capacity while the route to Willow Grove carried only 67, less than half the number on the Trenton route. The number of loaded 5 to 7½-ton trucks was 66 on Route 281 to Trenton and only 23 on Route 151 to Willow Grove.

Motor truck traffic into and out of Philadelphia on route 281 is influenced to a great extent by Trenton, New York City, and intermediate points. This is the main route between Philadelphia and New York City and carries a large volume of "through" traffic. Of all trucks moving into or out of Philadelphia on this route, 66.2 per cent originated at or were destined to New Jersey and New York points. Truck traffic on this route is influenced to a much greater extent by cities outside Pennsylvania than traffic on any other route in the Commonwealth. On route 180—132, Philadelphia to Wilmington, Del., a considerable part of the traffic also is due to cities in other

Table 18—Average daily density of total truck traffic by capacity classes, and traffic of 5 to 7½-ton loaded trucks near Philadelphia on the principal primary highways in 1924

Routes from Philadelphia		Daily total truck traffic			Daily traffic of loaded 5 to 7½-ton trucks
Number	To	All trucks	½ to 2½-ton trucks	3 to 7½-ton trucks	
142	Paoli	605	452	153	55
180	Chester	600	410	190	81
281	Trenton	336	195	141	66
151	Willow Grove	329	262	67	23
130	Media	301	224	77	17

states. The only other routes where truck traffic of any importance is due to outside influence are the routes into Erie from Buffalo on the east and Ashtabula and Cleveland on the west; the route into Beaver Falls from Youngstown, Ohio; and the route into Uniontown from Morgantown, W. Va.

The City of Pittsburgh is the center of the second most important motor trucking area. In this area there are three main trucking routes as shown in Figure 8. The first is route 70 from Pittsburgh northeast to Tarentum on the road to Kittanning; the second, the Lincoln Highway, route 20 to East Pittsburgh on the road to Greensburg; and the third, route 108 from Pittsburgh to Bridgeville on the road to Washington. The average daily density of motor truck traffic on each of these routes is shown in Table 19.

Route 70, to Tarentum, is the most important of the three main routes and carried, on an average day, 457 trucks of which 88 were 3 to 7½-ton trucks and 26 were loaded 5 to 7½-ton trucks. It is interesting to compare this route, the most important State route in the Pittsburgh area, with the principal routes in the Philadelphia area. Three routes in the Philadelphia area carry considerably more 3 to 7½-ton trucks and loaded 5 to 7½-ton trucks than route 70 from Pittsburgh to Tarentum.

Four additional State highways leading out of Pittsburgh are shown in Figure 8. With the exception of the route north to Bakerstown, they are relatively unimportant in comparison with the

three main routes. The route to Bakerstown had an average daily traffic of 166 trucks of which 43 were 3 to 7½-ton trucks and 11 were loaded 5 to 7½-ton trucks. There is an important motor truck movement northwest of Pittsburgh to Beaver and intermediate points. This traffic uses a county road on the east side of the Ohio River and is, consequently, not shown in Figure 8. The average daily number of trucks on this county road was 274 of which 20 were loaded 5 to 7½-ton trucks.

The third important area of motor truck traffic is in the northeast adjacent to the cities of Scranton and Wilkes-Barre. This, the anthracite coal area, has two important trucking routes. The first is a combination of route 5 from Wilkes-Barre to Scranton and route 6 from Scranton to Carbondale. Motor truck traffic was greatest just south of Scranton where the average daily number of all trucks was 626, of which 73 were 3 to 7½-ton trucks and 13 were loaded 5 to 7½-ton trucks. Between Scranton and Carbondale there was an average daily traffic of 364 trucks, of which 39 were of 3 to 7½-ton capacity.

The second route, on the west bank of the Susquehanna River, parallels the first route from Pittston to Wilkes-Barre and then continues southwest, through a number of small but fairly important towns. The average daily density of traffic on this highway was 378 motor trucks between Pittston and Wilkes-Barre (route 368), including an average of 42 trucks of 3-ton or larger capacity. South of Wilkes-Barre (route

Table 19—Average daily density of total truck traffic by capacity classes and traffic of 5 to 7½-ton loaded trucks near Pittsburgh on the principal primary highways in 1924

Route from Pittsburgh		Daily total truck traffic			Daily traffic of loaded 5 to 7½-ton trucks
Number	To	All trucks	½ to 2½-ton trucks	3 to 7½-ton trucks	
70	Tarentum	457	369	88	26
20	East Pittsburgh	417	343	74	21
108	Bridgeville	368	304	64	14

4) the total truck traffic reached 390 and the traffic of 3 to 7½-ton trucks was 77 per day.

Reading and Harrisburg are centers of population in the next most important area of motor truck concentration. Reading is the hub of important highways leading to Allentown, Pottsville, Harrisburg, and Philadelphia. The route to Allentown carried 268 trucks per day between Reading and Temple of which 55 were 3 to 7½-ton trucks, and 14 were loaded 5 to 7½-ton trucks. This route is the most important highway out of Reading from the standpoint of both total and large-capacity trucks.

Traffic on the important routes out of Harrisburg, with the exception of the route to Lancaster, is predominantly a local movement.

There are, in the southeastern section, several additional important areas of motor truck concentration. Pottsville and Shamokin are centers of population and industry in one of these areas. Coal, the principal commodity transported by trucks on these highways, accounted for 7 per cent of the motor truck movement. The distribution of vegetables, fresh meat, bread, and other food products constitutes a substantial part of the total truck movement in the area.

The cities of Allentown and Bethlehem form

the center of another area. The remaining areas surround York and Lancaster, that around Lancaster, which is the center of an agricultural rather than an industrial region, being the least important.

Two additional areas of motor truck traffic importance are found in the western section around Erie and Altoona. East of Erie on route 87 there was an average daily traffic of 180 trucks of which 10 were of 3-ton or larger capacity. West of Erie on route 86-272 the density of total truck traffic was 129, of which 12 were 3-ton or larger trucks. Traffic of loaded 5 to 7½-ton trucks was 2 east and 4 west of Erie on the above-mentioned routes. That the traffic of these large trucks was not greater is due mainly to the 20,000-pound gross load limitation of Ohio. The use of trailers, especially on route 86-272 west of Erie, is also due to this limitation. Of the loaded trucks on this route 5.3 per cent were truck-and-trailer combinations, the highest percentage of such combinations on any route.

South of Altoona on route 55 to Hollidaysburg the density of truck traffic was 268 trucks per day of which 55 were 3 to 7½-ton trucks. The number of loaded 5 to 7½-ton trucks on this route was 10 per day.

THE EFFECT OF SMALL POPULATION AND MOUNTAINS IN THE NORTHERN AND CENTRAL SECTION OF PENNSYLVANIA

The distribution of the total truck traffic and of loaded 5 to 7½-ton trucks (fig 8) shows the comparative unimportance of the northern and central section with respect to the provision of highway improvements for motor truck traffic.

The absence of large-capacity trucks and the small number of all trucks are evident in the entire northern and central section.

As it has been found that the concentration of motor trucks occurs around large centers of population and industry, so also it is true that an absence of motor truck traffic characterizes the highways in sparsely populated areas. As shown in Figure 8, the density of truck traffic on practically all highways in the north was less than 40 per day. These trucks were small in capacity and,

for the most part, equipped with pneumatic tires. In this section of Pennsylvania, therefore, where there are no large centers of population and where the population of many townships is decreasing, pavements designed to serve motor truck traffic will be unnecessary for a considerable number of years.

The south-central is of slightly more importance than the northern section from the standpoint of total truck traffic. With the exception of route 29 north of Lewistown, however, the average density of 3 to 7½-ton truck traffic was less than 20 per day. The mountains hinder the free movement of motor truck traffic in this section and together with the relatively small population in the area account for the absence of any appreciable volume of motor truck traffic.

MOTOR TRUCK LOADING

The motor truck movement over the State highway system as a whole is one of predominantly small-capacity trucks with light gross loads. This is seen in the fact that 56.6 per cent of the gross loads recorded were less than 6,000 pounds and only 2.4 per cent were over 24,000 pounds, as shown in Table 20.

Table 20—Distribution of loaded motor trucks by gross weight groups in 1924

Gross weight	Loaded trucks
Pounds	Per cent
Under 6,000	56.6
6,000—11,000	23.7
12,000—17,000	11.0
18,000—23,000	6.3
24,000 and over	2.4
Total.	100.0

Further evidence of the relatively light gross loading is seen in the comparatively low average gross weight of 7,600 pounds¹⁴ for all loaded

trucks, a weight which is fairly close to the average for 1½-ton trucks. As shown in Table 21,

Table 21—Average gross weights of loaded motor trucks of various capacities

Motor truck capacity	Average gross weight	Motor truck capacity	Average gross weight
Tons	Pounds	Tons	Pounds
½	2,490	3½	16,890
¾	4,190	4	17,700
1	4,120	5	20,490
1¼	5,170	5½	22,500
1½	7,020	6	21,990
2	9,390	6½	22,590
2½	11,480	7½	23,930
3	12,890	Average	7,600

average gross weights ranged from 2,490 pounds for ½-ton trucks to 23,930 pounds for 7½-ton trucks¹⁵.

¹⁴ Average gross load or weight refers, in this report, to the combined weight of truck and net load and is used here only in connection with loaded trucks.

¹⁵ For average gross weight of loaded trucks by capacity classes at transport survey weight stations see Appendix VI.

Table 22.—Routes of the primary system on which gross loads of 24,000 pounds or more are over 5 per day in 1924¹

Route			Gross loads per day of or in excess of 24,000 pounds	Gross loads per day between 18,000 and 24,000 pounds
Number	From	To		
142	Philadelphia	Paoli	19	23
281	Philadelphia	Trenton, N. J.	15	31
130	Philadelphia	Lansdowne	11	41
1	Harrisburg	Millersburg	7	43
132	Chester	Wilmington, Del.	6	42
151	Philadelphia	Willow Grove	6	15
157	Reading	Temple	6	11

¹ Includes only those routes on which motor trucks were weighed.

Heavy gross loads are confined to certain areas, which are substantially those areas where the greatest concentration of both total and large-capacity trucks exists. The probability of heavy gross loads is naturally greater in areas where a large volume of commodities is hauled on large-capacity trucks.

Reference to Table 22 shows that routes of the primary system having an average daily traffic of more than 5 gross loads of, or in excess of, 24,000 pounds are all in the southeastern part of Pennsylvania. The average daily number of various gross loads, according to classes, is shown in Appendix VII for those routes of the highway system where motor trucks were weighed.

Five of the routes included in Table 22 are also the most important trucking routes in the Philadelphia area from the standpoint of total truck traffic and the number of large-capacity trucks. Route 281 between Morrisville and Trenton, at the State line, carried on an average day 79 gross loads of 24,000 pounds or more, and 94 loads between 18,000 and 24,000 pounds. These trucks were engaged in a short-haul movement of sand and gravel from gravel pits near Morrisville to Trenton.

Route 157 (Table 22) was previously found to be the most important trucking route out of Reading. On route 1, designated here as the route from Harrisburg to Millersburg, there were 7 gross loads of 24,000 or more pounds per day and 43 between 18,000 and 24,000 pounds. These loads were part of a movement of river coal just north of Harrisburg. Trucks engaged in this movement constituted 22.4 per cent of the loaded truck traffic just north of Harrisburg and averaged 20,450 pounds gross weight.

It is evident that the highways in southeastern Pennsylvania, the most important trucking area carry more heavy gross loads than the highways of any other section. A smaller daily number of heavy gross loads was found on the highways of the Pittsburgh and Scranton—Wilkes-Barre areas. In general, heavy gross loads occur, with some degree of frequency or regularity, only on important highways radiating from the larger centers of population and industry.

On highways in the northern part of the Commonwealth, west of Scranton and Wilkes-Barre, and in the central section heavy gross loads either did not occur or, where they were found, were few and infrequent.



Lincoln Highway at Philadelphia City Line Before and After Construction of Dual Type Pavement

CHAPTER IV

HIGHWAY UTILIZATION

During the year period, November 1923 to November 1924, traffic over the rural highways of Pennsylvania was approximately 3,487,210,000 vehicle-miles. The total mileage of rural highways, including approximately 1,000 miles of the State highway system which were located within cities or boroughs, was approximately 93,194 miles. Upon the various systems the daily utilization varied from an average daily traffic of 1,051 on the 3,953 miles of the State primary system to 29 on the 80,736 miles of the township system.

The distribution of vehicle-mileage on the different highway systems and the approximate mileage of each system as of December 31, 1924 is shown in Table 23, and a comparison of traffic

on the primary and secondary systems and other rural highways is shown in Figures 11 and 12. It is estimated that, providing there is no marked change in the mileage of the various highway systems, this relative distribution of traffic by highway systems, will remain approximately constant during the next five years.

The State highway system with 11.0 per cent of the rural highway mileage carried 68.3 per cent of the traffic measured in vehicle-miles. That part of the State system which is designated as primary, comprising 4.2 per cent of total mileage carried 43.5 per cent of the traffic. Because of the large volume of traffic carried by the primary system it is evident that this system as a unit should be given first consideration in a plan of

Table 23—Motor vehicle utilization of Pennsylvania rural highways and highway mileage by systems in 1924

Road system	Miles	Per cent of total mileage	Daily vehicle—miles	Annual vehicle—miles	Per cent of total vehicle—mile- age	Vehicle— miles per mile (Average daily ¹)
Primary:						
Improved	3,223	3.4	3,901,000	1,423,865,000	40.8	1,210
Unimproved ...	730	0.8	254,000	92,710,000	2.7	348
Total	3,953	4.2	4,155,000	1,516,575,000	43.5	1,051
Secondary:						
Improved	2,728	2.9	1,617,000	590,205,000	16.9	593
Unimproved ...	3,593	3.9	754,000	275,210,000	7.9	210
Total	6,321	6.8	2,371,000	865,415,000	24.8	375
Total State	10,274	11.0	6,526,000	2,381,990,000	68.3	635
State aid:	505	0.6	173,000	63,145,000	1.8	343
County	1,679	1.8	514,000	187,610,000	5.4	306
Township	80,736	86.6	2,341,000	854,465,000	24.5	29
Total	93,194	100.0	9,554,000	3,487,210,000	100.0	103

¹ Average daily density.

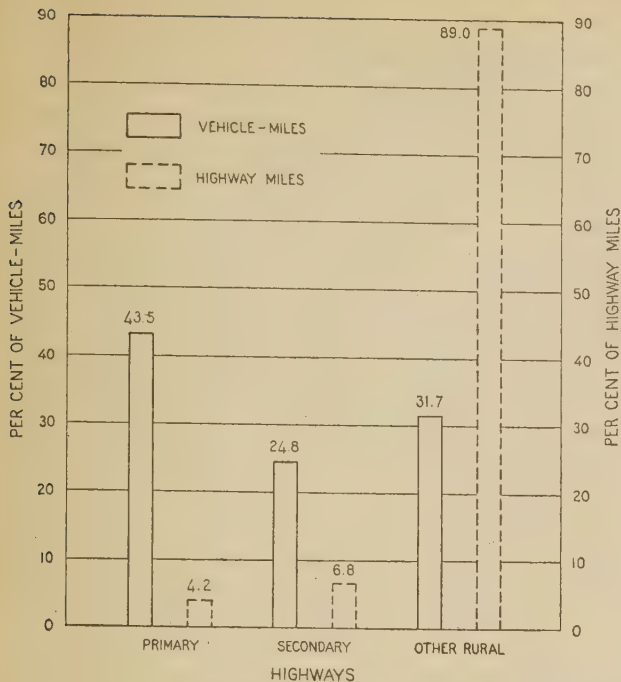


Fig. 11—Comparison of total traffic on the primary, secondary and other rural highways

highway improvement. With the exception of that part of the designated State primary system which is located within the limits of municipalities of over 2,500 population this system corresponds very closely with the designated Federal-aid system.

The State secondary system, with 6.8 per cent of the highway mileage, carried 24.8 per cent of the total rural highway traffic. As a unit this system is secondary in importance to the primary system, and should be so considered. The secondary system, however, includes a limited mileage of heavy-traffic routes, particularly in the vicinity of the larger cities, and the planning of improvements for these sections should take precedence over the light-traffic routes of the primary system.

The township system, with 86.6 per cent of the mileage, carried only 24.5 per cent of the traffic. Traffic on the township system is widely distributed. Although there were variations in the amount of traffic on different township roads, the amount of township highway mileage which carried a large volume of traffic was very small.

Within the different systems variations in traffic were also large. In the most densely populated section comprising Delaware, Lehigh, Montgomery, Northampton and Philadelphia Counties, traffic on the State system was 1,440 vehicle-miles per mile, and in the most sparsely populated section comprising 20 counties in the northern and central part of the Commonwealth traffic on the State system was only 289 vehicle-miles per mile. On individual sections of the State system average daily traffic varied from over 9,000 vehicle-miles per mile to less than 50 vehicle-miles per mile.

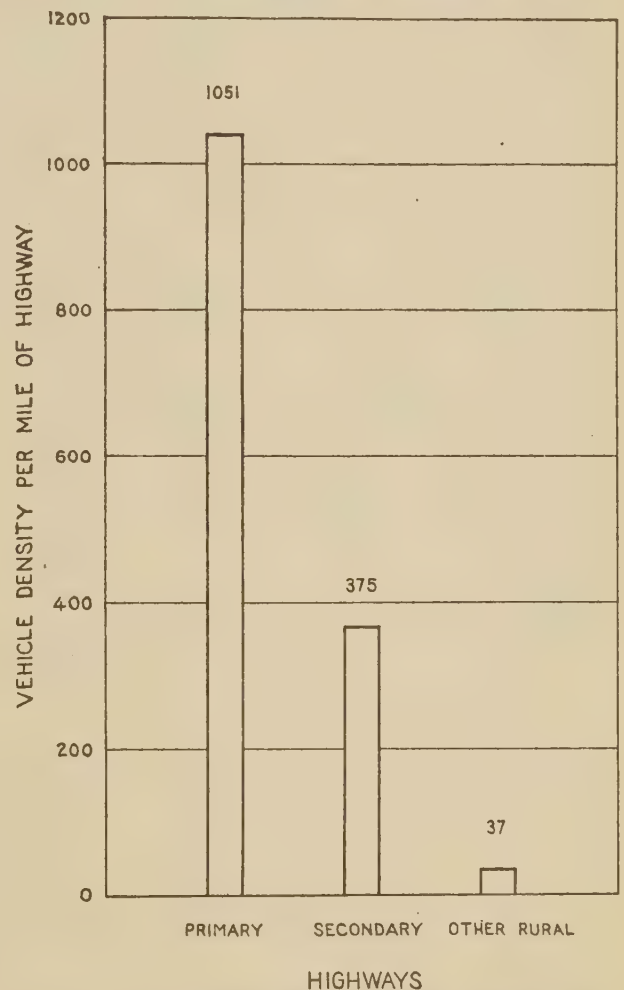


Fig. 12—Traffic density on the primary, secondary and other rural highways

A comparison of routes on the primary systems also indicates large variations in traffic volume. Daily traffic on the Lincoln Highway from the New Jersey line through Philadelphia to Pitts-

burgh, including approximately 290 miles of State highway, was approximately 550,000 vehicle-miles or an average of over 1,900 vehicle-miles per mile. Daily traffic on the primary highway crossing the northern part of the Commonwealth from Scranton, through Towanda, Wellsboro, Coudersport and Warren to the junction with route 84, south of Erie, including about 295 miles of State highway, was approximately 97,000 vehicle-miles, or an average of approximately 330 vehicle-miles per mile.

The differences in traffic on the improved and unimproved sections of the State highway system are also marked. Improved sections, as classi-

fied in Table 23, include concrete, asphalt, brick, bituminous macadam, and similar types; unimproved sections include earth, gravel, and similar types. On the primary system, average traffic on the improved sections was over three times the average traffic on the unimproved sections, and on the secondary system, average traffic on the improved sections was almost three times that on the unimproved sections.

In Table 24, the distribution of vehicle-mileage, into truck-mileage and passenger-car-mileage is shown by highway systems. The distribution of truck-miles and passenger-car-miles is very similar to the distribution of total vehicle-miles.

Table 24—Motor truck and passenger car utilization of Pennsylvania rural highways by systems in 1924

Road system	Daily truck-miles	Percentage of total truck-miles	Daily passenger-car-miles	Percentage of total passenger-car-miles	Annual truck-miles	Annual passenger-car-miles	Ratio of truck-miles to total vehicle-miles
Primary:							
Improved	345,000	38.8	3,556,000	41.0	125,925,000	1,297,940,000	8.8
Unimproved ...	24,000	2.7	230,000	2.7	8,760,000	83,950,000	9.4
Total	369,000	41.5	3,786,000	43.7	134,685,000	1,381,890,000	8.9
Secondary:							
Improved	152,000	17.1	1,465,000	16.9	55,480,000	534,725,000	9.4
Unimproved ...	66,000	7.4	688,000	8.0	24,090,000	251,120,000	8.8
Total	218,000	24.5	2,153,000	24.9	79,570,000	785,845,000	9.2
Total State ..	587,000	66.0	5,939,000	68.6	214,255,000	2,167,735,000	9.0
State aid	15,000	1.7	158,000	1.8	5,475,000	57,670,000	8.7
County	45,000	5.1	469,000	5.4	16,425,000	171,185,000	8.8
Township ¹	242,000	27.2	2,099,000	24.2	88,330,000	766,135,000	²
Total	889,000	100.0	8,665,000	100.0	324,485,000	3,162,725,000	9.3

¹ Estimated.

² Due to the small number of vehicles on any section of the township system an accurate expression of this ratio is not obtainable. It is, however, between 8 and 11 per cent of the total vehicle-miles.

CHAPTER V

COMPOSITION OF HIGHWAY TRAFFIC

Passenger Cars

The comparative use of the State highway system by vehicles of Pennsylvania and foreign registration, by city and farm-owned vehicles, and by various other classes of vehicle use can be expressed accurately in motor vehicle miles¹⁰.

The total passenger car use of the primary highway system on an average day during the traffic survey was 3,786,000 passenger-car-miles. The comparative use of this system by various classes of traffic use is shown in Table 25.

There are, however, wide variations in the composition of passenger car traffic on different parts of the primary system. Foreign traffic is largely limited to the areas adjacent to State boundaries and to the principal through routes. Touring traffic is largely limited to the main through routes such as the Lincoln Highway, the Susquehanna Trail the Lackawanna Trail, the National Pike, the Lakes-to-Sea Highway and the William Penn Highway.

Business and non-business traffic are quite evenly distributed over the primary system. Business

traffic is of greater importance on the routes adjacent to the larger cities and in the industrial areas. Non-business traffic is of greater importance on the principal through routes, the scenic routes, and in areas adjacent to pleasure resorts and places of historic interest.

Farm-owned traffic is local in character and is largely limited to a movement between farm areas and the market towns of these areas.

The composition of passenger car traffic shown in table 25, is based upon the year period. There is, however, a large seasonal variation in the composition of this traffic. Non-business and touring traffic are predominantly summer movements. Foreign traffic is also greater in summer than in

Table 25—Composition of passenger car traffic on the primary highway system as observed on the principal traffic routes in 1924

Type of passenger car traffic	Daily passenger-car-miles	Per cent of daily passenger-car-miles
State of registration:		
Pennsylvania	3,254,000	86.0
Foreign	532,000	14.0
Type of trip:		
Touring	219,000	5.8
Non-touring	3,567,000	94.2
Type of usage:		
Business	1,999,000	52.8
Non-business	1,787,000	47.2
Place of ownership:		
City	3,519,000	92.9
Farm	267,000	7.1
All Types	3,786,000	100.0

¹⁰ The various types of traffic as used in this and the following section are defined as follows:

State of Registration.

Pennsylvania—includes traffic of all motor vehicles registered in Pennsylvania.

Foreign—includes traffic of all motor vehicles not registered in Pennsylvania.

Place of Ownership.

Farm—includes traffic of all motor vehicles owned by persons residing on farms.

City—includes traffic of all motor vehicles owned by persons residing in cities, villages or urban areas.

Type of Usage.

Business—indicates that the car on the trip recorded was being used for business purposes.

Pleasure—indicates that the car on the trip recorded was being used for pleasure or recreational purposes.

Type of Trip.

Touring—includes all trips of more than one day duration taken primarily for recreation.

Non-touring—includes all other trips.

Type of Trucking.

For-hire—includes all trucks engaged in hauling commodities on a contract or tariff basis.

winter except in the areas adjacent to State lines where little seasonal variation in the proportion of State and foreign traffic is observed. Business traffic and traffic of farm-owned cars show less seasonal variation than non-business traffic and traffic of city-owned cars. A marked variation in

Table 26—Distribution of passenger car traffic on the primary highway system by length of trip¹

Length of trip	Per cent of cars observed	Cumulative per cent
<i>Miles</i>		
0- 9	22.3	
10- 19	22.0	44.3
20- 29	11.2	55.5
30- 39	6.9	62.4
40- 49	3.8	66.2
50- 59	4.9	71.1
60- 69	3.0	74.1
70- 79	2.0	76.1
80- 89	2.0	78.1
90- 99	1.9	80.0
100-149	5.9	85.9
150-199	3.0	88.9
200-299	3.5	92.4
300 & over	7.6	100.0
Total	100.0	

¹ Based on 156,000 cars observed at 100 selected points on the principal traffic routes of the primary highway system. Length of trip is calculated from origin to destination, including street mileage as well as State highway mileage.

the proportion of business and non-business usage is also observed between Sundays and other days of the week. Sunday traffic is predominantly non-business in character. A larger proportion of business traffic in any day is observed during the morning hours than during the afternoon hours.

The number of passengers per car also varies considerably with the type of passenger car use. The average number of passengers per car for all types of traffic was 2.6; touring and non-business usage averaged more than 3 persons per car and business traffic averaged 2.0 persons per car.

Over half of the passenger car traffic observed on the principal traffic routes of the primary highway system was made up of cars traveling less than 30 miles per trip. The distribution of this traffic by length of trip is shown in Table 26.

A larger proportion of long-distance trips were found on the important through routes. On these routes, trips of over 100 miles made up 24.1 per cent of the traffic; on the remaining routes such traffic was 15.2 per cent of the total.

Composition of Highway Traffic— Motor Trucks

Daily truck-mileage on the State highway system was approximately 587,000 truck-miles. Of this sum approximately 369,000 truck-miles were on the primary system and 218,000 truck-miles on the secondary system.

Table 27—Distribution of truck-miles by State of registration

State of registration	State highway system					
	Total		Primary		Secondary	
	Daily truck-miles	Per cent	Daily truck-miles	Per cent	Daily truck-miles	Per cent
Pennsylvania	561,000	95.6	350,000	94.9	211,000	96.8
Foreign	26,000	4.4	19,000	5.1	7,000	3.2
Total	587,000	100.0	369,000	100.0	218,000	100.0

The utilization of Pennsylvania highways by motor trucks of foreign registration is of less importance than in the case of passenger cars. The relative use of these highways by trucks of Pennsylvania and foreign registration is shown in Table 27.

Traffic of trucks of foreign registration is of little significance except in parts of the Commonwealth adjacent to the surrounding States, and within these areas is important only on the principal interstate highways.

Trucks operating for hire, either on a contract or tariff basis, produce 13.8 per cent of the motor-truck-mileage on the State highway system. The average cargo of trucks operated for hire is approximately double the average load of other trucks. The distribution of traffic of trucks operated for hire and of privately operated trucks is shown in Table 28.

Table 28—Distribution of traffic of trucks operated for hire and of privately operated trucks

Type of trucking	Daily truck-miles	Percentage of daily truck-miles
For hire	81,000	13.8
Privately operated .	506,000	86.2
Total	587,000	100.0

As between contract haulage and tariff haulage the former is of considerably greater importance in terms of tonnage transported.

Motor trucking is primarily a short-haul movement. The distribution of truck traffic by trip-mileage, based on the operation of 452,000 loaded trucks, is shown in Table 29.

Of all loaded motor trucks observed, 80.6 per cent operate less than 30 miles per trip. Those traveling less than 50 miles per trip are 91.2 per cent of all loaded trucks, and only 2.7 per cent of the loaded trucks make trips of 100 miles or more. The long-haul transportation of commodities by

motor truck is largely limited to the movement of a small number of commodities where speed of delivery or special packing requirements are the determining factor.

Table 29—Distribution of loaded trucks by trip-mileage

Length of trip	Loaded trucks	Cumulative per cent
Miles	Per cent	
0- 9	37.4	
10-19	29.6	67.0
20-29	13.6	80.6
30-49	10.6	91.2
50-99	6.1	97.3
100 & over	2.7	100.0
Total	100.0	

The average net cargo weight and gross weight of loaded trucks, and the average weight of empty trucks by capacity groups is shown in Table 30.

Table 30—Average net and gross weight of loaded trucks by capacity groups, and average weight of empty trucks

Capacity group	Average weight		
	Net cargo	Gross	Empty
Tons	Pounds	Pounds	Pounds
½-1½	1,050	4,160	3,110
2 -2½	3,410	10,270	6,860
3 -4	5,790	15,450	9,660
5 -7½	8,420	20,620	12,200

Net cargo tonnage represents the weight of commodities carried; gross tonnage includes the total weight of truck and load for all trucks, loaded and empty.

The total daily ton-mileage utilization of the State highway system is approximately 405,000 net cargo ton-miles, and 1,804,000 gross ton-miles. The distribution of this tonnage by highway systems is shown in Table 31.

The importance of the Pennsylvania State highway system is clearly indicated in Table 31. Daily commodity transportation is 405,000 ton-miles, and during the year period this movement

is approximately 148,000,000 ton-miles. The total tonnage transported on the State highway system is probably between 5,000,000 and 6,000,000 tons for the year period.

Table 31—Daily net cargo and gross ton-miles of truck traffic by highway systems

Highway system	Daily net ton-miles-cargo		Daily gross ton-miles	
	Ton-miles	Per cent	Ton-miles	Per cent
Primary, total	265,000	65.4	1,160,000	64.3
Improved	252,000	62.2	1,098,000	60.9
Unimproved	13,000	3.2	62,000	3.4
Secondary, total	140,000	34.6	644,000	35.7
Improved	101,000	25.0	461,000	25.6
Unimproved	39,000	9.6	183,000	10.1
Total State system	405,000	100.0	1,804,000	100.0

CHAPTER VI

HIGHWAY TRAFFIC AND POPULATION

The volume of highway traffic in an area is closely related to the population of the area.

Highway traffic is predominantly local in nature and the influence upon the volume of traffic in an area, of traffic originating at points more than 40 or 50 miles distant is generally small, except in areas which attract large numbers of tourists such as parks pleasure resorts, and in areas of relatively low population density which are traversed by highway routes connecting important centers of population.

The largest volume of traffic is found in the areas adjacent to the larger cities and in the areas having the greatest density of population. The concentration of traffic on the routes leading into the cities of Philadelphia, Pittsburgh, Scranton, Reading, Erie, Harrisburg, Wilkes-Barre, Allentown, Bethlehem, Johnstown, Altoona, Chester, Lancaster, and York, the 14 largest cities, is apparent. Traffic, measured in vehicle-miles, on the primary and secondary State highway systems in the Counties of Bucks, Chester, Delaware, and Montgomery, the area of which is approximately equivalent to that of a semi-circle of 36-mile radius drawn about the City of Philadelphia, is approximately one-sixth of the total traffic on the State highway system. A large part of this traffic, particularly in Bucks and Chester Counties which have a relatively low density of population compared with the other counties, originates in Philadelphia County, which, being co-extensive with the City of Philadelphia, has no State highways. Traffic on the State highway system of these four counties, which comprise 4.6 per cent of the area of the Commonwealth, is approximately equal to the traffic in 22 northern counties which comprise 36.6 per cent of the total area. The Counties of Bucks, Chester, Delaware, Montgomery and Philadelphia comprise 27.5 per cent of the total population, as compared with 9.2 per cent for the 22 northern counties. Similar, al-

though less pronounced, variations are found in other localities.

On the basis of total motor vehicle traffic, motor truck traffic, the composition of truck traffic, population density, and population trends, three geographical sections are apparent. Within each of these major sections the distribution of highway traffic and population again indicates certain natural divisions. Divisions have all been made on county lines, as the commonly accepted boundaries, although the natural divisions of traffic and population do not in all cases follow county boundaries.

The three major sections are: The eastern, which includes 18 counties each of which had a population density of more than 100 persons per square mile in 1920 and an increasing population between 1910 and 1920; the western, which includes 20 counties, 15 of which had a population density of more than 90 persons per square mile in 1920, and 17 of which had an increasing population between 1910 and 1920; and the northern and central, which includes 29 counties, the majority of which show a low density of population and 18 of which show a decrease in population between 1910 and 1920. The total population within this area decreased 1.9 per cent during these years. Within each section the following divisions were made:

Division A.

Philadelphia, Delaware, Montgomery, Lehigh and Northampton Counties. These counties range in density of population from 13,712.6 persons per square mile in Philadelphia County to 411.8 persons per square mile in Montgomery County. The rate of increase in population between 1910 and 1920 ranges from 17.5 per cent in Montgomery County to 46.8 per cent in Delaware County.

Division B.

Lackawanna and Luzerne Counties. Both these counties exceed 400 persons per square mile, but the rate of increase is considerably lower than in division A.

Division C.

Dauphin, Berks, Schuylkill and Northumberland Counties. These counties rank below divisions A and B in both population density and rate of increase. Population density ranges from 293.6 persons per square mile in Dauphin County to 232.2 persons per square mile in Berks County. The rate of population increase between 1910 and 1920 ranges from 12.5 per cent in Dauphin County to 4.7 per cent in Schuylkill County.

Division D.

The remaining counties in the eastern section, i. e., Bucks, Carbon, Chester, Cumberland, Lancaster, Lebanon and York Counties. Population density in these counties ranges from 110.9 in Cumberland County to 175.4 in Lebanon County. The rate of population increase between 1910 and 1920 for all counties except Carbon, which shows an increase of 18.4 per cent, ranges between 4.1 and 7.8 per cent.

Western section**Division A.**

Allegheny, Westmoreland, Fayette, Washington, Beaver and Lawrence Counties. With the exception of Allegheny County, which has a population density of 1,635.6 persons per square mile, these counties range from 219.2 to 263.3 persons per square mile. The rate of population increase ranges from 12.3 per cent in Fayette County to 42.5 per cent in Beaver County.

Division B.

Blair and Cambria Counties. Blair County has 240.3 persons per square mile and Cambria County 275.9 persons per square mile. The rate of population increase between 1910 and 1920 was 17.9 per cent in

Blair County and 19.1 per cent in Cambria County.

Division C.

Erie County. This county has a population density of 196.6 persons per square mile and an increase of 32.9 per cent between 1910 and 1920. It is classed separately because of its location and the importance of interstate traffic on its highways.

Division D.

The remaining counties in the western section, i. e., Mercer, Armstrong, Indiana, Somerset, Butler, Clearfield, Venango, Greene, Jefferson, Clarion and Crawford Counties. Population density in this group ranges from 134.0 persons per square mile in Mercer County to 58.2 persons per square mile in Crawford County. Population changes between 1910 and 1920 range from an increase of 22.2 per cent in Indiana County to a decrease of 1.6 per cent in Jefferson County. Three counties, Jefferson, Clarion and Crawford show decreasing population during this period; three counties, Greene, Butler and Venango, increases of less than 10 per cent; two counties, Armstrong and Clearfield, increases of between 10 and 20 per cent; and three counties, Indiana, Somerset and Mercer, increases of over 20 per cent.

Northern and central section**Division A.**

Adams and Franklin Counties. These counties are on the border between the relatively densely populated eastern section and the sparsely populated central section. Population density is 65.5 persons per square mile in Adams and 82.9 persons per square mile in Franklin County. Both counties show small increases in population between 1910 and 1920. In highway traffic this section, particularly Adams County, is peculiar in the large amount of traffic originating in other sections, due to the importance of the Gettysburg National Park as an attraction to tourists.

Division B.

Columbia, Montour, Mifflin, Lycoming, Snyder and Union Counties. These counties form the most densely populated part of the northern and central section. Population density ranges from 108.3 persons per square mile in Montour County to 52.0 persons per square mile in Union County. Three of these counties, Mifflin, Lycoming, and Snyder, increased in population between 1910 and 1920; and three, Columbia, Montour and Union decreased during the same period. Increases or decreases are small except in Mifflin County which shows an increase of 13.2 per cent.

Division C.

Monroe County. This county, having a population density of 39.0 persons per square mile and an increase of 5.9 per cent between 1910 and 1920, is classed separately because of its very heavy traffic in proportion to population and motor vehicle registration. The relatively heavy traffic is due to the importance of the county as a summer-resort area and to the fact that it is traversed by an important "through-traffic" route, the Lackawanna Trail.

Division D.

The remaining counties of the northern and central section, i. e., Bedford, Bradford, Cameron, Centre, Clinton, Elk, Forest, Fulton, Huntingdon, Juniata, McKean, Perry, Pike, Potter, Sullivan, Susquehanna, Tioga, Warren, Wayne and Wyoming Counties. Of these counties Centre, Clinton, Huntingdon, McKean and Warren show increases of population ranging from 1.1 to 6.4 per cent; all other counties show a decreasing population between 1910 and 1920. Persons per square mile range from 49.6 in McKean to 12.5 in Pike County.

These sections and divisions are shown in Figure 7, and summary of their population and traffic data is shown in Table 32. Traffic data are presented as daily vehicle-miles on the State high-

way system, including the primary and secondary systems. This item represents the volume of traffic on the State highway system in each area, and vehicle-miles per mile indicates the average density of traffic in the area.

Analysis of the distribution of population, motor vehicle registration, area, mileage of State highways, and vehicle-mileage on the State highway system, (Table 32) indicates that highway traffic expressed in vehicle-miles, does not vary in exact ratio with any one of these factors.

Vehicle-mileage varies directly with population but the proportion of population exceeds the proportion of vehicle-mileage in the densely populated areas (divisions A and B of the eastern, and divisions A and B of the western section); in all other sections the proportion of vehicle-mileage exceeds the proportion of population.

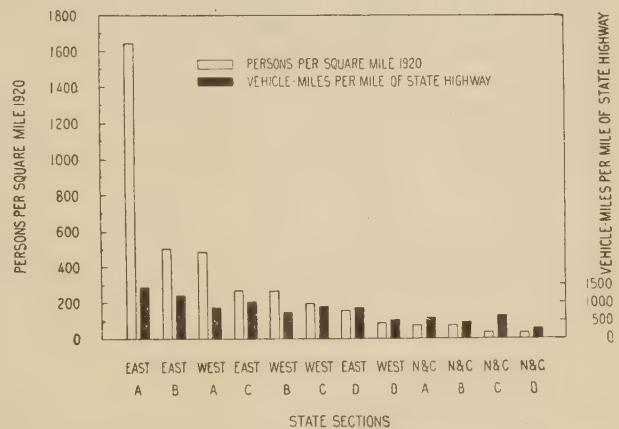


Fig. 13—Density of population and density of motor vehicle traffic on State highways by sections of the Commonwealth

The relationship between population and traffic on the State highway system is more definitely indicated by a comparison of population density and traffic density. In Figure 13, population density per square mile and vehicle-miles per mile of State highway are plotted for each section. To facilitate comparison the sections have been arranged in order of population density. The decrease in traffic density with decrease in population density is apparent but is marked by certain irregularities. Analysis of this comparison will indicate that a number of factors affect the re-

relationship between population and traffic on the State highway system and preclude the expression of this relationship by any simple mathematical formula. The most apparent lack of direct relationship is found in divisions A and B of the eastern section and division A of the western section where the ratio of traffic density on the State highway system to population density is far below the corresponding ratio in the other groups. The

explanation of this variation is found in two factors:

1. The population in these sections is largely urban in character and the traffic on city streets may therefore be expected to be greater in proportion to traffic on rural highways in these sections than in the other sections, as shown by Table 33.

Table 32—Population, traffic on State highway system, and motor vehicle registration, by sections

Section	Percentage					Persons per square mile 1920	Percentage increase in population 1910-1920 ¹	Daily vehicle-miles		
	Population 1920	Vehicle-miles on State highway system	Motor vehicle registration 1924	Area	State highway miles			per highway mile	per registered vehicle	per person
Eastern										
A	28.6	11.6	23.0	3.4	5.1	1,645.4	19.9	1,440	2.66	.30
B	7.8	5.5	6.3	2.9	2.9	504.3	12.4	1,204	4.58	.53
C	8.0	10.3	8.4	5.9	6.4	265.1	8.6	1,015	6.49	.97
D	8.0	16.9	10.8	10.1	12.7	154.8	6.7	851	8.29	1.58
Total	52.4	44.3	48.5	22.3	27.1	456.9	14.8	1,039	4.82	.63
Western										
A	23.3	13.5	22.3	9.4	9.9	483.0	19.0	873	3.20	.43
B	3.8	2.8	3.5	2.8	2.4	260.7	18.6	721	4.21	.55
C	1.8	2.8	2.4	1.7	2.0	196.6	32.9	883	6.09	1.18
D	8.7	14.3	10.8	19.4	17.9	87.7	10.0	507	6.97	1.23
Total	37.6	33.4	39.0	33.3	32.2	219.4	17.3	658	4.52	.67
Northern and Central										
A	1.1	2.9	1.4	2.9	3.3	75.7	2.9	553	10.66	1.95
B	2.4	4.6	3.0	6.3	6.5	73.8	2.4	450	7.97	1.42
C	0.3	1.4	0.5	1.4	1.4	39.0	5.9	636	15.30	3.85
D	6.2	13.4	7.6	33.8	29.5	35.9	-4.5	289	9.33	1.61
Total	10.0	22.3	12.5	44.4	40.7	44.0	-1.9	348	9.39	1.66
Grand Total	100.0	100.0	100.0	100.0	100.0	194.5	13.8	635	5.27	0.75

¹ Minus (—) indicates decrease.

2. In these sections and also in division B of the western section there is a greater number of persons per car than in other sections; i. e., there is a small proportion of car ownership from which a lower car use in relation to population would naturally follow. The number of persons per car in the various sections is shown in Table 34.

Comparison of daily vehicle-miles per person and daily vehicle-miles per registered vehicle in

the different areas (Table 32) also indicates the factors which affect the relationship of population and traffic. This comparison is shown graphically in Figure 14. The sections are arranged in order of population density, and therefore in approximate order of traffic density. Although total motor vehicle traffic on the State highway system and density of traffic on individual routes in the densely populated areas is much greater than the total density of traffic by routes in the sparsely populated areas, vehicle-mileage on the State sys-

Table 33—Distribution of urban and rural population and cities of over 10,000 population by sections¹

Section	Percentage of total urban population of Commonwealth	Percentage of total rural population of Commonwealth	Ratio of urban to total population of section	Number of cities with a population of over 10,000				
				Total	10,000-25,000	25,000-50,000	50,000-100,000	over 100,000
Eastern	Per cent	Per cent	Per cent					
A	39.4	9.3	88.3	7	1	2	3	1
B	9.6	4.5	79.5	11	8	1	1	1
C	7.7	8.4	62.5	10	8	....	1	1
D	5.3	13.0	42.2	9	7	1	1	....
Total	62.0	35.2	76.0	37	24	4	6	3
Western								
A	23.8	22.5	65.6	25	22	2	....	1
B	3.4	4.3	58.4	2	....	....	2	....
C	1.9	1.5	70.3	1	....	....	1	....
D	4.3	16.7	31.9	7	7	....	....	....
Total	33.4	45.0	57.3	35	29	2	3	1
Northern and Central								
A	0.5	2.2	28.5	2	1	1	....	....
B	1.6	3.9	42.6	1	1	....	....	....
C	0.2	0.4	41.7	....	....	....	....	....
D	2.3	13.3	24.1	2	2	....	....	....
Total	4.6	19.8	29.5	5	4	1	....	....
Grand total	100.0	100.0	64.3	77	57	7	9	4

¹ Based on 1920 census.

Table 34—Estimated number of persons per registered motor vehicle, 1924

Section	Estimated persons per car
Eastern:	
A	9.46
B	9.12
C	6.96
D	5.41
Total	8.08
Western:	
A	7.91
B	8.15
C	5.74
D	5.92
Total	7.24
Northern and central:	
A	5.53
B	5.67
C	4.08
D	5.72
Total	5.62
Grand Total ..	7.45

tem per person and per registered vehicle is greater in the sparsely populated areas than in the densely populated areas. This relationship is the natural result of the higher proportion of urban population in the densely populated areas and the resulting lesser use per vehicle and per person of State highways in these areas, as compared with the sparsely populated areas in which a larger proportion of total motor vehicle traffic is found on the State highways.

The effect of variations in persons per car is shown by the relative height of the two columns for each area. In the sections having the larger number of persons per car, vehicle-mileage per car is relatively greater than vehicle-mileage per person; in the areas having the smaller number of persons per car, vehicle-mileage per person is relatively greater than vehicle-mileage per car. The greatest divergence is seen in division C of the northern and central section, in which persons

per car is lower than in any other section and is only 55 per cent of the State average.

The presence or absence of important traffic routes which are not included in the State highway system must also be considered in an analysis of the relation of traffic on the State highways to population. Several counties have county highway systems which include important traffic routes. This is particularly true in division A of the western section in which 44 per cent of the total mileage of designated county highways is located. In this area the county highways are equivalent in mileage to 73 per cent of the State highways. Allegheny County, the first county to develop a distinct county highway system, has 467 miles of county highways, including several routes of considerable traffic importance. Other areas in which county highways form an important part of the total highway mileage are division B of the eastern section and division B of the western section. In these areas, however, the county highways are generally of less traffic importance.

The effect of these county highways in diffusing traffic and lowering the density of traffic on the State highways is evident from Figure 14. The relatively lower vehicle-mileage per person and per vehicle in divisions A and B of the western section indicates the effect of important county highways in these areas.

In certain sections traffic originating without the area may form an important part of the total traffic in the area. This is particularly true in areas which attract large volumes of foreign

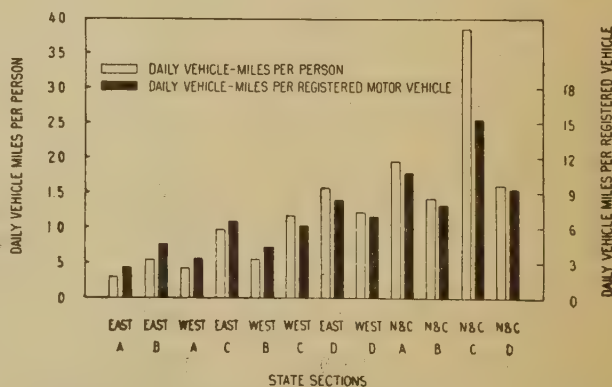


Fig. 14—Daily traffic on State highways per person and per registered motor vehicle by sections of the Commonwealth

traffic, such as parks, pleasure resorts, and places of historic interest, and areas adjacent to but not including large cities. The effect of such foreign traffic will be to abnormally increase the vehicle-mileage per person and per vehicle.

Reference to Figure 14 will indicate that three areas appear to have abnormally high vehicle-mileage per person and per vehicle. These areas in order of importance are: division C, northern and central section; division A, northern and central section; and division D, eastern section. Division C of the northern and central section (Monroe County) is an important summer resort area which attracts a large volume of summer traffic, and is also traversed by an important "through-traffic" route, the Lackawanna Trail. Division A of the northern and central section includes Adams County, in which is located the Gettysburg National Park which attracts a large number of tourists.

Division D of the eastern section includes Bucks and Chester Counties which are adjacent to Philadelphia and Cumberland County which is adjacent to Harrisburg.

The effect of foreign traffic, i. e. traffic originating at points outside the area of a county or State, is particularly marked in the case of Bucks and Chester Counties. The daily vehicle-miles per person on the State highways of Bucks County are more than three times the State average and are nearly double the average for counties of similar population density. The corresponding ratios for Chester County are not as high as in Bucks County but greatly exceed those of other counties of similar population density. In both these counties traffic originating in Philadelphia forms an important part of the total highway traffic. Foreign traffic in Bucks County probably exceeds that in Chester County due to the fact that the principal route from Philadelphia to Trenton, N. J., and New York City passes through this county.

Subject to the variations produced by the factors discussed above—variations in urban and rural population and resulting variations in the distribution of traffic between rural highways and city streets, variations in motor vehicle owner-

ship, variations in important traffic routes which are not included in the State highway system, and variations in the amount of foreign traffic on the highways of an area—the population of an area is a reliable measure of the total traffic on the State highway system within areas of considerable size.

For small areas or individual routes other factors are involved which may largely vitiate the value of this measure of traffic. Traffic between two centers of population may be concentrated on one route or may use two or more alternative routes. A poor highway surface or congested traffic conditions will discourage the use of a route. An excellent highway surface, adequate width, and scenic or other attractions along the way will increase the traffic on the route.

Population is of particular importance in anticipating the traffic needs of an area. Population trends for areas of considerable size can be accurately determined and generally change slowly. Future population can be predicted with reasonable accuracy and serves therefore the most reliable basis of anticipating future highway needs.

An analysis of the relation of highway traffic to the population of a State is also valuable as a guide to highway finance. The preceding analysis indicates that although there is a definite relationship between population and traffic, there is no uniform mathematical relationship, particularly when applied to relatively small areas such as county units. Because of the many variables which affect this relationship it is evident that the distribution of highway construction or maintenance funds upon the basis of population, motor vehicle registration, highway mileage or similar methods might under certain circumstances result in an inequitable distribution to certain areas.

The variations in population density and in population trends within counties are also great. To obtain an accurate picture of population density and trends, population data were computed on a township basis. The eastern section and divisions A, B and C of the western section include nearly all the important areas of dense population and also of rapidly increasing population. In the re-

maining sections small areas of dense population are found at the larger cities or boroughs but these sections include no population centers of first importance. Regions of rapidly increasing population in these sections are also small in area and scattered in location. The proportion of the area of each section having a density of population of less than 100 persons per square mile, 100—199 persons per square mile, and 200 or more persons per square mile; and the proportion of the total population of the section residing in each of these areas are shown in Table 35.

For the entire Commonwealth, classified on the basis of township units, 13.4 per cent of the area

has a population of 200 or more persons per square mile, and this area includes 77.9 per cent of the population; 75.0 per cent of the area has a population of less than 100 persons per square mile, and this area includes only 14.1 per cent of the population. The largest proportion of densely populated area is found in division A of the eastern section and the smallest proportion in division D of the northern and central section.

These variations in the amount of densely populated areas and variations in the proportion of the total population residing in such areas indicate marked differences in the demands for highway service in the area. In an area such as

Table 35—Area and population by sections classified by density of population per square mile, 1920

Section	Percentage of total area having a population of—			Percentage of total population residing in areas having a population of—		
	Less than 100 persons per square mile	100 to 199 persons per square mile	200 and over persons per square mile	Less than 100 persons per square mile	100 to 199 persons per square mile	200 and over persons per square mile
Eastern:						
A	31.1	17.9	51.0	1.3	1.5	97.2
B	63.5	5.2	31.3	4.2	1.4	94.4
C	60.5	20.2	19.3	11.4	10.3	78.3
D	62.1	20.0	17.9	21.7	16.8	61.5
Total	57.2	17.7	25.1	6.4	5.2	88.4
Western:						
A	41.3	16.3	42.4	3.9	5.0	91.1
B	44.3	27.2	28.5	9.2	13.9	76.9
C	69.0	19.9	11.1	13.8	11.7	74.5
D	75.5	16.7	7.8	36.7	25.4	37.9
Total	62.9	17.6	19.5	12.6	10.9	76.5
Northern and Central:						
A	84.0	8.2	7.8	53.2	15.9	30.9
B	89.1	5.0	5.9	37.0	10.1	52.9
C	89.9	5.9	4.2	47.5	27.4	25.1
D	94.8	3.2	2.0	70.5	11.4	18.1
Total	93.1	3.9	3.0	59.9	12.0	28.1
Grand total	75.0	11.6	13.4	14.1	8.0	77.9

division A of the eastern section where only 31.1 per cent of the area has a population of less than 100 persons per square mile, it is evident that a highway system designed to carry a large volume of traffic between the important centers of population will be required.

The routes connecting the important centers of population must be of sufficient width and of a type adequate to carry a large volume of traffic. Such routes should be as direct as possible and all obstructions to the free and rapid movement of traffic such as railway grade crossings, sharp curves, heavy grades and congestion areas in the smaller villages should be eliminated.

Traffic originating in the sparsely populated sections of such an area will be relatively unimportant and can be served by short "feeder" routes connecting these sections with the main routes.

In divisions A and B of the eastern section and division A of the western section traffic originating in the densely populated areas forms the predominant part of highway traffic, as over 90 per cent of the total population of these sections resides in areas having a population of 200 or more persons per square mile.

In contrast with these areas are the northern and central section and division D of the western section in which less than 50 per cent of the population resides in areas having a population of 200 or more persons per square mile and from 75.5 to 94.8 per cent of the area has a population of less than 100 persons per square mile. In these areas the volume of traffic is smaller and its sources more scattered, resulting in lower density of traffic on the highways. Very few important centers of population are found in this region; the area has only one city with a population of over 25,000 and only 12 cities of over 10,000 population in 1920 (Table 33); and traffic from the sparsely populated sections forms a predominant part of the total. The population and traffic data indicates that except in the immediate vicinity of the larger cities, Williamsport, Butler, Sharon, Oil City, Bradford, Meadville, Warren, Du Bois and Chambersburg, and on the important "through-traffic"

routes such as the Lincoln Highway, the Lakes-to-Sea Highway, the William Penn Highway, the Susquehanna Trail and the Lackawanna Trail, traffic in this area is very light. Here the demand is principally for highways which will serve as large an area as possible. Highway width in excess of the normal two-lane road is not required. In these areas expensive removal of obstructions to the rapid movement of traffic is secondary in importance to the provision of a large mileage of serviceable highways.

Division D of the eastern section and divisions B and C of the western section are partially in the first and partially in the second class. In the areas near the important centers of population either included in the section or contiguous to it heavy traffic will be concentrated on a few important routes; in the outlying areas very few heavy routes are to be found.

The proportion of the area of each section which increased in population between 1910 and 1920 and the rate of increase or decrease in areas having less than 100 inhabitants per square mile, 100 to 199, and 200 or more inhabitants per square mile in each section is shown in Table 36.

Table 36 indicates that in every section the areas having a population in 1920 of 100 or more persons per square mile increased in population between 1910 and 1920. The areas which had in 1920 a population of less than 100 persons per square mile decreased in population between 1910 and 1920 except in divisions A and B of the western section.

If this trend continues—and its continuance may reasonably be expected, although the rate of increase and decrease may change—the greatest increase in traffic will be found in the densely populated areas. In small areas of sparse population surrounded by or contiguous to areas of dense population, traffic originating in the densely populated areas will dominate the highways of the smaller area but in the northern and central section, where areas of increasing population are small, a rapid increase in traffic is not expected.

Table 36—Area increasing in population and rate of increase or decrease for areas of different present population density by sections, 1910 to 1920

Section	Percentage of area increasing in population	Percentage of area decreasing in population	Percentage of population increase, 1910 to 1920 ¹			
			Total area	Area having less than 100 persons per square mile 1920	Area having 100 to 199 persons per square mile 1920	Area having over 200 persons per square mile 1920
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Eastern:						
A	62.3	37.7	19.9	—6.3	3.4	20.7
B	59.3	40.7	12.4	—4.1	10.9	13.3
C	43.2	56.8	8.6	—4.0	5.4	11.2
D	39.1	60.9	6.7	—5.4	1.7	13.4
Total	46.4	53.6	14.8	—5.0	3.4	17.3
Western:						
A	71.6	28.4	19.0	7.3	20.8	19.4
B	73.2	26.8	18.6	1.8	13.4	22.1
C	45.9	54.1	32.9	—1.1	15.6	45.6
D	45.4	54.6	10.0	—1.0	16.2	18.6
Total	55.2	44.8	17.3	0.7	17.0	20.6
Northern and Central						
A	43.8	56.2	2.9	—1.2	4.7	9.9
B	32.8	67.2	2.4	—6.6	4.7	9.3
C	26.9	73.1	5.9	—6.5	14.1	28.2
D	21.6	78.4	—4.5	—9.0	15.0	4.7
Total	24.8	75.2	—1.9	—7.9	11.1	7.9
Grand total	39.7	60.3	13.8	—4.5	11.2	18.1

¹ Minus (—) indicates decrease.

CHAPTER VII

FORECAST OF HIGHWAY TRAFFIC

All highway improvements, although varying in degree of permanency are of the nature of permanent improvements. Proposed highway improvements to be adequate must be planned so as to provide service for future traffic as well as for present traffic. The building of a highway which will not meet traffic demands during the expected life of the improvement will result in traffic congestion and early reconstruction and is therefore an uneconomic investment of public funds. Building in excess of traffic needs is also uneconomic as it involves an outlay of funds which could be used more advantageously for other highway improvements. When the trend of traffic increase is unknown the principle of stage construction in highway development is a conservative method of adjusting highway improvement to traffic needs. A knowledge of future traffic, insofar as it can be predicted with reasonable accuracy, is, however, extremely valuable in the establishment of a sound plan of highway improvement.

Prediction on the basis of past trends of development has been found accurate for population, business conditions, railway traffic and other eco-

nomic factors. This method, however, is possible only when the trend is known over a considerable period of years and when the period is one of normal development.

No comprehensive record of highway traffic over a series of years is available in Pennsylvania and the direct prediction of traffic on the basis of past trends is therefore impossible. Records of motor vehicle registration for a series of years are available and the experience of other States has indicated that there is a close and practically constant relation between the rates of growth of highway traffic and motor vehicle registration.

In Massachusetts records of highway traffic at 3-year intervals are available since 1909. A summary of the motor vehicle traffic at 18 common stations and motor vehicle registration in that State for the same years, is given in Table 37.

That traffic and registration have increased at nearly equal rates throughout the 16 years covered by the traffic records is shown by comparison of the indices computed with the average year as a base, as shown in the table.

Table 37—Massachusetts motor vehicle traffic and registration by years, 1909 to 1924

Year	Motor vehicle traffic at 18 stations		Motor vehicle registration	
	Number of passenger cars and trucks	Index ¹	Number of passenger cars and trucks	Index ¹
1909	2,974	12.0	23,971	11.0
1912	6,891	27.8	50,132	23.1
1915	12,660	51.1	102,633	47.3
1918	21,022	84.8	193,497	89.2
1921	36,396	146.9	360,732	166.3
1924	68,720	277.4	570,578	263.0

¹ Indices based on the traffic and registration of the average year, which are taken as 100.0.

In Maine, Maryland and Wisconsin, also, both traffic and registration records are available for a number of years. The agreement between the traffic and registration trends in these States is indicated in Table 38, which presents the indices of registration and traffic with the average year 1919 to 1924 as a base.

The number of traffic stations in these States varies from 26 in Maine to 200 in Maryland. In Figure 15 the curves of traffic and motor vehicles registration in the three States have been brought into proximity by the adjustment of the plotting scales,¹⁷ and to the data least-square lines of trend have been fitted (shown by the dotted lines). It will be seen that the trends of traffic and registration in Maine and Maryland are almost parallel. In Wisconsin the traffic appears to be increasing at a slightly faster rate than the registration, but this divergence is partially explained by the fact that traffic data for 1919 are probably low.¹⁸

Traffic and registration in these widely separated areas have obviously increased at approximately equal rates despite differences in industrial development, wealth and population. It may, therefore, be assumed that what is true of these States, widely separated in location and greatly different in character, will also be true in Pennsylvania, namely, that registration and traffic increase at approximately equal rates, and that the prediction of motor vehicle registration may be

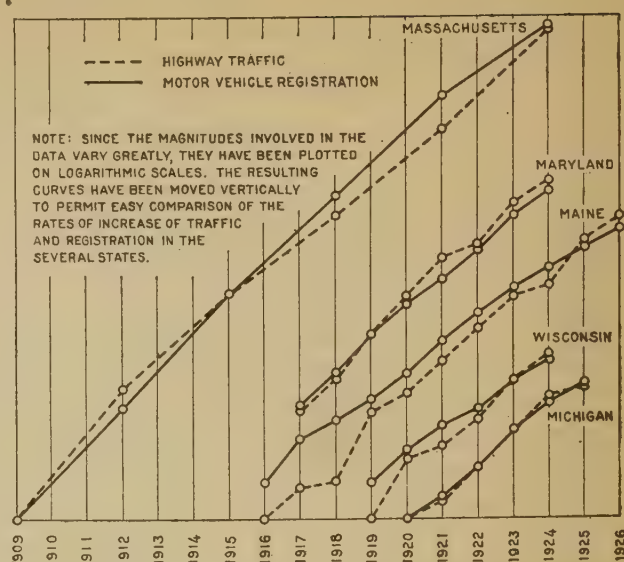


Fig. 15—Trends of highway traffic and motor vehicle registration in Massachusetts, Maryland, Maine, Wisconsin and Michigan

taken as the basis for a prediction of motor vehicle traffic.

It may not be assumed that the future traffic will be distributed in exactly the same proportions as the present traffic on the various routes and sections of routes. The development of new highways, the construction of parallel or "by-pass"

¹⁷ Since the data are plotted on a logarithmic scale, adjustment of the curves does not affect the comparability of the trend rates.

¹⁸ The Wisconsin Highway Department states that the 1919 traffic average is low in comparison with later years. This was the first year the traffic was observed and not all data were recorded.

Table 38—Indices of registration and traffic in Maine, Maryland and Wisconsin

Year	Maine		Maryland		Wisconsin	
	Registration	Traffic	Registration	Traffic	Registration	Traffic
1919	61.8	61.7	59.8	56.6	63.4	53.1
1920	72.7	70.5	73.0	72.2	78.7	78.3
1921	89.6	87.3	85.1	92.0	91.7	84.8
1922	107.0	106.9	103.5	100.5	102.6	101.1
1923	125.5	131.3	128.3	130.3	122.7	129.5
1924	143.4	141.7	150.0	150.0	140.9	153.1

routes adjacent to the larger cities, unusual industrial or resort developments, and suburban expansion will affect the traffic in smaller areas. But with respect to an entire highway system, all the facts that it is possible to analyze indicate that the forecast of expected registration over a short period will give a reasonable measure of the traffic that may be expected.

The estimate of future traffic on the basis of predicted motor vehicle registration neglects, of course, such factors as the effect of major mechanical improvements to vehicles and assumes further, that the average mileage per vehicle per year will show no important change over the prediction period. It would seem, from the nature of the case, that any such change would be gradual, and would not be likely to affect greatly a prediction made for a period of five or ten years in the future.

Another factor that must be considered is the effect of traffic congestion upon the rate of traffic increase. With respect to the traffic on an entire State highway system, the effect of this factor is likely to be of little importance for the State system as a whole, at least during the next few years, although it may operate to reduce somewhat the rate of traffic increase on highways near the large centers of population.

It appears reasonable, therefore, that a prediction of future motor vehicle traffic may be made upon the basis of a prediction of motor vehicle registration. The latter can be made upon the basis of records of past years, available for the Commonwealth. The increase of motor vehicle registration is a function of two variables: (1) The increase in population; and (2) the increasing use of motor vehicles in proportion to population, which can be measured by the number of persons per motor vehicle.

The population of Pennsylvania by decades is shown in Table 39.

From the data shown in Table 39 and interpolation for inter-censal years it is possible to obtain a reliable forecast of population for a short period of years. The interpolated population values for

Table 39—Population of Pennsylvania, 1790 to 1920

Year	U. S. Census	Increase over preceding census enumeration	
		Number	Per cent
1790	434,373		
1800	602,365	167,992	38.7
1810	810,091	207,726	34.5
1820	1,049,458	239,367	29.5
1830	1,348,233	298,775	28.5
1840	1,724,033	375,800	27.9
1850	2,311,786	587,753	34.1
1860	2,906,215	594,429	25.7
1870	3,521,951	615,736	21.2
1880	4,282,891	760,940	21.6
1890	5,258,113	975,222	22.8
1900	6,302,115	1,044,002	19.9
1910	7,665,111	1,362,996	21.6
1920	8,720,017	1,054,906	13.8

the years 1913 to 1920 and predicted values from 1920 to 1930 are shown in Table 40.

The growth of motor vehicle registration in proportion to population appears to follow the same general characteristics as the growth of population, namely, an early growth slow in number of vehicles but at a rapid rate, followed by a gradual decrease in the rate of growth. Applying the same general method of forecasting that is used for population to motor vehicle registration and combining with the estimated increase of motor vehicle registration in proportion to population, the estimated increase in population, the predicted registration to 1930, as shown in Table 40, is obtained.¹⁹

It is estimated that the registration of motor vehicles in Pennsylvania in 1930 will be 2,086,000, an increase of 69.7 per cent over the 1924 registration.

The resulting numbers of persons per car in each year to 1930 are also shown in Table 40. On the basis of predicted population and motor vehicle registration it is estimated that in 1930 there will be one registered motor vehicle for each 4.75 persons. The actual and estimated registration and persons per registered vehicle from

¹⁹ For a detailed discussion of methods of forecasting motor vehicle registration see Lowell J. Reed, "A Form of Saturation Curve," *Journal American Statistical Association*, September, 1925.

HIGHWAY TRANSPORTATION SURVEY

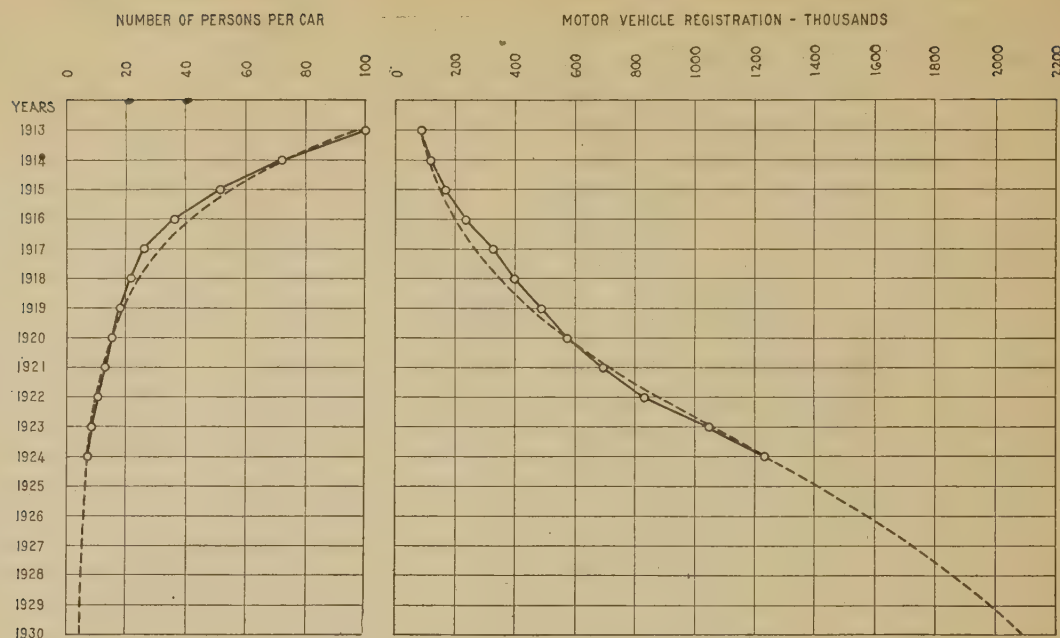


Fig. 16—Motor vehicle registration and persons per car

Table 40—Comparison of population and the number of motor vehicles in Pennsylvania

Year	Registration (thousands)		Population (thousands)	Persons per car	
	Actual	Estimated		Actual	Estimated
1913	78.9	80	7,883	99.9	98.4
1914	111.3	109	8,002	71.9	73.6
1915	160.6	147	8,122	50.6	55.3
1916	230.6	197	8,241	35.8	41.9
1917	325.2	262	8,360	25.7	31.9
1918	394.2	344	8,480	21.5	24.6
1919	482.1	447	8,600	17.8	19.3
1920	570.2	570	8,720	15.3	15.3
1921	689.6	714	8,840	12.8	12.4
1922	829.7	876	8,959	10.8	10.2
1923	1,064.6	1,050	9,078	8.53	8.65
1924	1,228.6	1,229	9,199	7.49	7.48
1925	1,362.8	1,406	9,318	6.84	6.63
1926	1,490.9	1,574	9,437	6.33	6.00
1927	1,592.2	1,728	9,556	6.00	5.53
1928		1,864	9,675		5.19
1929		1,999	9,793		4.94
1930		2,086	9,911		4.75

1913 to 1924 and the projection of these trends to 1930 are shown in Figure 16.

Applying the principle developed above, that the rate of traffic increase is equivalent to the rate of increase in motor vehicle registration, it is estimated that traffic for the Commonwealth as a whole will increase 69.7 per cent between 1924 and 1930.

The present number of persons per car varies considerably in different parts of the Commonwealth, as does also the rate of population growth.²⁰

To allow for differences in the increase in registration and in traffic in the different counties the number of persons per car based on estimated population in 1924 for each county were obtained. To this 1924 value for each county was applied the rate of State average decrease in persons per car between 1924 and 1930. The estimated registration for each county in 1930 was then obtained by applying the estimated number of persons per car in 1930 for each county to the estimated 1930 population of the county. From the actual county registration in 1924 and the

estimated registration in 1930 the percentage increase in registration and in traffic for the county was obtained. This method results in the same total for the Commonwealth as a whole and reflects the difference between counties in intensity of registration in 1924 as well as differences in county rates of population growth. The expected registration and traffic growth, 1924 to 1930, varies from 11.1 per cent in one of the northern counties which has a rapidly decreasing population, to 84.7 per cent. in Delaware County which has the highest rate of population increase of all the counties.

The expected average daily traffic in 1930 at each of the survey stations as determined by applying the county rates of traffic increase to each of these stations is shown in Appendix II.

Because of possible industrial and suburban developments as well as changes in the highway system both as to location of routes, routing of traffic, and types of improvement it is not expected that these estimates will in all cases reflect exactly the actual traffic in 1930, but it is believed that they will reflect with reasonable accuracy the traffic in areas of considerable size and on routes of considerable length.

²⁰ See discussion of Motor Vehicle Traffic and Population, pp—

APPENDIX I

COMMODITIES TRANSPORTED

The kinds of commodities hauled on the highways of Pennsylvania vary, to a great extent, with the type of industries in the several sections. Products of manufacture, as shown in Table 41 form the principal class of commodities transported over the highways. This class includes a large number of individual commodities and is the most important part of the commodity movement on practically every highway.

Table 41—Classification of commodities carried by motor truck¹

Class of commodities	Net cargo tonnage
	Per cent
Products of manufacture -----	60.3
Products of mines -----	13.1 ²
Products of animals -----	10.9
Products of agriculture -----	9.0
Products of forests -----	6.7 ²
Total -----	100.0

¹ Based on an analysis of 216,000 net tons of commodities.

² Short-haul movements occurring only on certain areas.

The more important commodity items in products of manufacture are gasoline, groceries, and used household furniture. These are commodities which are hauled on practically all of the State highways; and together they constitute over 14 per cent of all motor truck tonnage. The average length of haul of these commodities varies greatly. The transportation of gasoline is a short haul movement. Used household furniture, on the other hand, is consistently hauled longer distances than any other commodity. Most of the trucks hauling this commodity travel over 50 miles per trip, the predominant length of trip being between 100 and 150 miles. The average net load of used household furniture is approximately 3,000 pounds and of gasoline 4,000 pounds.

Products of mines are the next most important class of commodities from the standpoint of per-

centage of total net tonnage. The important commodities in this class are clay, gravel, sand, stone, and coal. The transportation of these commodities depends largely upon the location of pits, quarries, and mines and is naturally confined to certain areas. In such areas the movement of these commodities is an important part of the total net tonnage. For example, on route 228, northeast of Pittsburgh, coal constitutes 64.6 per cent of the total motor truck net tonnage. Trucks engaged in this movement carry an average net load of 8,300 pounds over an average distance of 16 miles. On route 281, between Morrisville and Trenton, N. J., 48.6 per cent of the motor truck tonnage hauled is sand and gravel. This is a short-haul movement of 3 miles, the net loads averaging 10,970 pounds. Although these products of mines are a considerable part of the motor truck tonnage in certain areas, their relative importance in highway transportation is lessened by the fact that they occur as motor truck commodities in a very limited number of areas and are hauled for short distances only.

Products of animals, composing 10.9 per cent of total tonnage, are the third largest class of commodities. Of this class milk and cream are the principal individual commodities. Their total tonnage is 60.2 per cent. of the tonnage of products of animals and 6.3 per cent of all motor truck tonnage. Milk, cream and other dairy products, although their tonnage is not great, are hauled on practically all routes of the highway system. The balance of the net tonnage of products of animals is composed chiefly of meat and packing house products.

Products of agriculture of some kind are hauled on all highways, even though their tonnage is but 9.0 per cent of total net tonnage. The most important commodities in this class are fresh fruits and vegetables which together constitute 5.4 per cent of all motor truck tonnage and 60.0 per

cent of products of agriculture. They form one of the most important individual commodity movements on nearly every highway. The average net load of fruits and vegetables weighs approximately 2,000 pounds and is hauled between 20 and 30 miles. There are some products of agriculture which are grown and hauled only in certain areas. Raw tobacco, for instance, composes 14.0 per cent of the total net tonnage of commodities on route 148, north of Lancaster. These special movements, however, do not form an appreciable proportion of the total tonnage.

Products of forest, the least important class of commodities, are, like products of mines, restricted to certain areas. They constitute a considerable part of the total net tonnage on a very few routes. One of these is route 4, southwest of Wilkes-Barre, where the tonnage of products of forests is 38.8 per cent. of the total motor truck tonnage. The movement of products of forests is limited in most cases to 25 miles, most of the hauls being under 20 miles. Net loads range from 2,000 to 4,000 pounds.

Table 42 shows the classification of motor trucks according to the nature of their origin and destination based on data obtained with respect to 215,045 loaded trucks.

The importance of retail deliveries to consumers is indicated by the fact that 21.9 per cent of all loaded trucks originate at retail establishments and the same proportion terminate at consumers. Movements to and from retail establishments, wholesale establishments and con-

sumers, which may be classed as the distribution of consumption goods comprise 56.3 per cent of the origins and 50.1 per cent of the destinations.

Manufacturing companies are also important sources and destinations of motor trucks; this movement is composed of the transfer of goods in process between manufacturing plants and the delivery of finished materials. Farms are the origin of 7.8 per cent and the destination of 6.9 per cent of all trucks. Movement to and from terminals constitutes approximately 6 per cent of the truck movement. Construction and repair jobs, which are the destination of 11.0 per cent of all trucks, are the principal destinations in the movement of building materials.

Table 42—Types or origin and destination of loaded trucks

Types of origin or destination	Loaded trucks by types of origin	Loaded trucks by types of destination
	Per cent	Per cent
Retail establishments	21.9	28.0
Wholesale establishments	20.9	10.2
Original source of supply ¹	6.0	1.1
Manufacturing companies	18.4	12.9
Terminals ²	6.0	6.3
Farms	7.8	6.9
Consumers ³	13.5	21.9
Storage ⁴	1.9	0.8
Construction and repairs	3.0	11.0
Miscellaneous	0.6	0.9
Total	100.0	100.0

¹ Includes mines, quarries, sand and gravel pits, and gas and oil wells.

² Railroad and motor truck terminals.

³ Residences, institutions, hotels and restaurants.

⁴ Warehouses and stock and junk yards.

APPENDIX II

MOTOR VEHICLE TRAFFIC AT TRANSPORT SURVEY STATIONS

(Average Daily Passenger Cars and Motor Trucks, Maximum Daily and Forecast of Traffic 1930)

County	Route no.	(New) Station No.	Average daily number of motor vehicles—1924			Forecast of average daily traffic 1930	County	Route no.	(New) Station No.	Average daily number of motor vehicles—1924			Forecast of average daily traffic 1930
			Trucks	Passenger cars	Total					Trucks	Passenger cars	Total	
Adams	P 41	80	35	460	495	790		S 115	388	219	1,481	1,700	2,890
		348	36	468	504	800		P 120	389	27	286	1,700	2,890
		349	23	298	321	510			4	275	2,686	2,971	5,000
		350	17	222	239	350			88	417	3,432	3,849	6,550
	P 42 & 230	81	78	574	652	1,040		P 187	89	83	644	727	1,240
	P 42	351	76	555	631	1,000		S 228	5	234	1,498	1,732	2,950
		352	75	551	626	1,000		S 246	6	130	1,300	1,430	2,430
		353	82	605	687	1,090			390	274	2,739	3,013	5,130
	P 43	354	93	684	777	1,240			391	90	887	987	1,680
		82	52	1,124	1,176	1,870		S 247	392	62	623	685	1,170
	S 44	355	51	1,101	1,152	1,870			7	320	1,622	1,942	3,300
		356	97	942	1,039	1,800		S 257	393	285	1,450	1,735	2,950
		357	28	253	281	460			8	70	631	701	1,190
		358	18	164	182	286		S 288	394	91	815	906	1,540
		359	35	323	358	570		C. R.	90	75	834	909	1,550
	P 123	84	33	775	808	1,290	Armstrong	S 66	1,348	274	1,328	1,602	2,730
		360	44	1,029	1,073	1,700		S 67	395	58	765	823	1,370
	P 126	361	27	628	655	1,040		P 69	396	32	324	356	600
		362	60	1,158	1,218	1,940			9	32	433	465	780
	P 126	363	59	1,143	1,202	1,910		P 71	397	45	613	658	1,100
		364	45	875	920	1,490			91	52	840	892	1,430
		365	46	804	940	1,490			398	57	925	982	1,640
	S 190	366	67	1,297	1,364	2,170		P 189	399	35	565	600	1,000
		367	33	307	340	540			40	370	410	410	1,110
	S 230	368	85	785	870	1,340		S 203	400	172	1,555	1,757	2,930
		369	68	629	697	1,110			401	239	2,387	2,626	4,350
	S 231	370	18	167	185	320	Beaver	P 76	402	59	765	824	1,190
	P 298	371	117	1,086	1,203	1,910		P 77	403	75	751	826	1,510
		372	35	692	727	1,160		S 78	92	102	2,856	3,228	5,900
	S 342	373	29	576	605	960			404	87	1,132	1,219	2,250
		374	67	474	541	960		P 204	405	41	542	583	1,070
		375	32	298	330	520			93	83	1,040	1,123	2,050
		376	15	189	154	420			406	115	1,436	1,551	2,840
		377	8	76	84	230			407	105	1,314	1,419	2,560
		378	13	116	129	360			1,349	154	1,557	1,711	3,130
		379	74	682	756	1,200	Bedford	P 39	12	84	861	945	1,610
		380	28	260	288	790			94	18	275	283	500
		381	61	567	628	1,130			408	85	868	953	1,620
	P 70	382	242	1,145	1,387	2,440			409	69	707	776	1,320
		383	166	1,270	1,436	2,440			410	59	606	665	1,190
	P 72	384	148	1,129	1,277	2,170			95	30	178	208	640
	P 72	385	164	1,253	1,417	2,410		P 47	411	50	296	346	930
		386	39	386	425	720		P 47	412	56	336	392	1,070
	P 76	387	49	488	537	910		P 48	413	20	258	278	610
		388	368	2,479	2,847	4,850			414	38	497	535	800
	P 108	389	472	3,187	3,659	6,230	Berks	P 119	415	19	241	260	810
		390							416	60	856	916	1,500
		391							417	37	520	557	1,500
		392							418	24	542	580	980
		393							419	24	219	243	670

P 146	418	66	610	676	1,860	1,120	Bradford	13	P 471	15	142	157	560	240
	13	183	1,616	1,799	4,950	2,980			S 472	29	284	313	1,170	480
	98	181	2,607	2,788	7,670	4,620		P 14	P 473	29	280	309	1,160	480
	419	166	1,464	1,680	4,480	2,700			P 109	28	536	564	2,120	870
	420	219	3,157	3,376	9,280	5,600				36	696	732	2,740	1,130
S 147	421	22	200	222	610	370		15	P 474	18	175	198	720	560
	422	54	498	552	1,520	920			P 475	92	892	984	3,690	1,510
	423	89	823	912	2,510	1,510				92	708	775	2,910	1,190
P 148	424	276	1,554	1,890	5,030	3,030			P 476	15	147	162	610	230
	425	164	573	675	1,860	1,120		P 17	P 477	11	110	121	450	130
	426	167	922	1,086	2,990	1,800			P 478	64	846	910	3,410	1,400
P 149	427	349	1,967	1,104	3,040	1,830				16	209	225	840	350
	14	102	1,054	2,309	6,350	3,830		S 20 & 209		35	278	313	1,170	480
P 149	100	270	2,746	3,016	7,110	4,920		S 20		11	356	382	1,430	560
	428	125	1,268	1,393	3,830	2,310				26	238	255	940	390
	429	143	1,445	1,588	4,370	2,630				23	322	345	1,290	530
	430	281	2,837	3,118	8,570	5,170				15	209	224	840	340
P 157	431	268	2,254	2,522	6,940	4,180				24	334	358	1,340	550
	432	209	1,762	1,971	5,420	3,510		P 212		19	284	273	1,020	420
	433	156	1,820	1,476	4,060	2,450				24	231	255	960	360
	101	135	1,137	1,272	3,500	2,110				20	129	149	560	800
P 160 & 285	434	329	2,771	3,100	8,520	5,140				21	203	224	840	360
P 160	435	174	1,446	1,640	4,510	2,720				43	414	457	1,710	700
	436	183	1,540	1,723	4,740	2,860				14	141	155	580	240
	437	187	1,575	1,762	4,850	2,920				22	212	234	880	360
	438	196	1,657	1,853	5,100	3,070				55	538	593	2,220	910
S 197	102	42	282	324	890	540		P 241		10	99	109	410	170
	439	108	724	832	2,290	1,380		P 287		73	1,134	1,197	4,490	1,840
	440	29	195	224	620	370				37	563	600	2,250	920
S 244	441	58	541	569	1,650	980				65	1,000	1,065	3,990	1,610
	442	23	217	240	660	400		S 299		72	1,103	1,175	4,410	1,800
	443	24	219	243	670	400				26	258	284	1,060	440
S 274	444	78	718	796	2,190	1,320		S 308		24	230	254	950	390
	445	28	264	292	800	480				40	390	430	1,610	660
S 284	446	60	639	708	1,950	1,170				30	294	324	1,220	500
	447	58	535	593	1,630	980				134	874	1,008	2,770	1,660
	448	103	953	1,056	2,900	1,750				117	1,074	1,267	3,480	2,080
	449	71	655	736	2,000	1,200				193	812	936	2,570	1,540
S 285	450	27	248	275	760	460				142	959	1,071	2,940	1,760
S 310	451	83	398	444	1,220	740		P 151		154	1,007	1,161	3,130	1,910
	452	59	509	568	1,500	940				142	925	1,067	2,930	1,750
	453	41	351	382	1,080	650				134	1,820	1,854	5,370	3,210
	16	98	476	574	1,550	950				118	1,886	1,706	4,680	2,800
P 47	454	101	490	551	1,600	1,010		152	P 503	119	1,599	1,718	4,720	2,820
	455	150	728	878	2,370	1,500			S 504	48	544	592	2,010	1,200
P 53	104	144	1,208	1,352	3,650	2,320				48	789	859	2,360	1,410
P 55	17	126	1,733	1,859	6,880	3,180		P 153		33	373	406	1,130	670
	105	295	2,214	2,509	9,280	4,300				505	505	501	1,380	820
	456	216	2,962	3,178	11,760	5,410				33	373	406	1,130	670
	457	293	4,011	4,304	15,930	7,370				134	1,052	1,186	3,260	1,950
	458	125	1,711	1,836	6,790	3,140				145	1,137	1,282	3,530	2,110
	459	101	1,381	1,482	5,480	3,140				126	991	1,117	3,070	1,840
	460	68	934	1,062	3,710	2,540		S 154		153	1,302	1,355	3,730	2,230
P 57	106	54	361	1,015	3,760	1,720		155		37	389	376	1,030	620
	461	58	1,039	1,097	4,060	1,890				40	504	544	1,500	890
S 221	107	208	456	664	2,460	1,140			S 505	59	690	749	2,060	1,230
	462	319	699	1,018	3,770	1,740			S 506	43	539	582	1,600	960
P 260	18	70	463	533	1,440	910		P 156		33	392	425	1,170	700
	463	160	1,059	1,219	4,510	2,090				160	1,841	2,001	5,500	3,250
	464	93	615	708	1,910	1,210				131	1,505	1,636	4,500	2,690
	465	102	677	779	2,100	1,350				91	1,051	1,142	3,140	1,840
P 260	466	76	507	583	1,570	1,000		P 178		113	1,304	1,417	3,900	2,300
	467	70	467	537	1,450	920				77	730	807	2,220	1,330
S 286	468	88	390	437	1,620	750		S 252		47	462	510	1,400	840
	469	85	397	452	1,300	850				48	462	510	1,400	840
	470	74	344	418	1,130	720				47	430	477	1,310	780
										23	216	239	640	390
										23	241	267	730	440
										17	160	177	490	290
										23	210	233	660	390
										23	210	233	660	390

Blair

Bucks

HIGHWAY TRANSPORTATION SURVEY

MOTOR VEHICLE TRAFFIC AT TRANSPORT SURVEY STATIONS—Continued

County	Route no.	(New) Station No.	Average daily number of motor vehicles—1924			Forecast of average daily traffic 1930	County	Route no.	(New) Station No.	Average daily number of motor vehicles—1924			Forecast of average daily traffic 1930
			Trucks	Passen- gers	Total					Trucks	Passen- gers	Total	
Butler	251	P 21	883	5,788	6,676	10,970	Carbon	P 162	135	119	745	864	2,380
		S 124	336	3,273	3,609	5,930			568	126	778	899	2,470
		S 524	88	859	947	1,560			569	214	1,320	1,534	2,420
		P 525	146	1,426	1,572	2,580			136	164	1,212	1,376	2,630
		S 526	75	733	808	2,220			571	200	1,482	1,682	2,860
		P 527	415	2,706	3,121	5,130			570	38	354	392	2,890
		S 326	528	229	254	700			571	40	516	556	670
		S 362	529	229	254	810			572	29	378	407	950
		P 71	530	477	529	1,460			573	64	827	891	1,580
		P 72	531	24	226	690			574	70	906	976	2,450
		P 73	532	23	373	1,070			575	94	1,548	1,642	2,680
		P 73	533	64	1,597	4,310			576	16	161	177	2,620
Cambria	75	S 534	72	1,438	1,510	2,600	Centre	P 27 & 56	S	138	138	1,642	1,660
		S 535	72	1,438	1,510	2,600			P	57	21	207	2,620
		S 536	64	1,363	1,427	2,320			P	57	21	207	2,620
		S 537	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 538	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 539	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 540	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 541	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 542	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 543	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 544	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 545	53	1,121	1,174	1,910			P	57	21	207	2,620
Cameron	78	S 546	53	1,121	1,174	1,910	Chester	P 133 & 143	S	138	138	1,642	1,660
		S 547	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 548	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 549	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 550	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 551	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 552	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 553	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 554	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 555	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 556	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 557	53	1,121	1,174	1,910			P	57	21	207	2,620
Cameron	214	S 558	53	1,121	1,174	1,910	Chester	P 133 & 143	S	138	138	1,642	1,660
		S 559	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 560	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 561	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 562	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 563	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 564	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 565	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 566	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 567	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 568	53	1,121	1,174	1,910			P	57	21	207	2,620
		S 569	53	1,121	1,174	1,910			P	57	21	207	2,620

101

[illegible]

HIGHWAY TRANSPORTATION SURVEY

MOTOR VEHICLE TRAFFIC AT TRANSPORT SURVEY STATIONS—Continued

County	Route no.	(New) Station No.	Average daily number of motor vehicles—1924			Forecast of aver- age daily traffic 1930	County	Route no.	(New) Station No.	Average daily number of motor vehicles—1924			Forecast of aver- age daily traffic 1930
			Trucks	Passen- ger cars	Total					Trucks	Passen- ger cars	Total	
Delaware	S 140	172	96	885	981	1,640	Fayette	P 86 P 87	758	51	1,332	1,383	2,480
		717	230	2,112	2,342	3,930			39	180	2,380	2,560	4,960
		718	73	713	786	1,330			184	86	2,254	2,340	4,190
	P 169	713	91	838	929	1,560		88 88 & 304 88	759	159	2,116	2,275	4,080
		719	75	691	766	1,280			760	142	1,886	2,028	3,680
		720	40	372	412	690			761	76	2,571	2,647	4,740
	P 199	721	50	460	510	860		S 185 S 186 S 187	762	91	566	657	1,180
		722	70	631	701	1,090			763	5	138	143	1,200
		723	82	768	850	1,420			764	83	516	589	1,070
	P 130 & 225	724	102	949	1,051	1,700		S 258	765	34	208	242	2,220
		725	88	818	906	1,520			766	50	640	690	2,550
		726	762	7,824	8,586	15,860			767	79	1,076	1,155	2,070
	P 131 & 135	727	301	3,156	3,457	6,380		P 272 P 50	768	44	564	608	2,250
		728	811	8,303	9,114	16,830			769	171	2,180	2,441	4,370
		729	339	3,473	3,812	7,040			770	44	2,270	2,351	4,370
	P 132	730	175	1,713	1,889	3,490		S 112 P 113	771	31	1,150	1,181	1,980
		731	176	1,839	2,015	3,850			772	209	2,669	2,898	4,800
		732	134	1,308	1,442	2,660			773	98	1,157	1,255	2,110
	S 133	733	534	3,756	4,290	7,920		P 117	774	106	1,374	1,480	2,480
		734	84	818	902	1,670			775	257	3,020	3,277	5,500
		735	79	773	852	1,570			776	162	1,911	2,073	3,480
	P 135	736	596	4,207	4,803	8,870		S 247	777	42	1,683	1,779	2,680
		737	536	5,632	6,168	11,390			778	770	2,666	2,934	4,250
		738	178	1,866	2,044	3,780			779	164	1,399	1,563	2,630
	P 142	739	113	1,187	1,300	2,400		P 36	780	122	1,044	1,166	1,960
		740	73	732	811	1,500			781	106	1,500	1,606	2,700
		741	605	4,802	5,407	9,940			782	189	1,620	1,772	2,970
	S 179	742	46	421	467	840		P 98 P 35	783	152	1,420	1,538	2,580
		743	235	212	235	430			784	118	1,815	1,943	3,260
		744	45	414	459	850			785	195	2,339	2,534	4,250
	P 180	745	600	3,133	3,733	6,900	Forest Franklin	S 44	786	147	1,558	1,705	2,860
		746	767	3,998	4,765	8,800			787	112	1,122	1,234	2,070
		747	808	4,210	5,018	9,270			788	36	359	395	660
	P 225	748	117	844	961	1,780		P 37	789	102	1,023	1,125	1,890
		749	742	408	765	1,610			790	78	1,090	1,168	2,600
		750	48	343	391	720			791	66	917	983	1,580
	P 59	751	109	1,145	1,254	1,580		P 43	792	78	1,092	1,170	2,700
		752	276	2,902	3,178	2,320			793	100	1,397	1,497	2,410
		753	46	421	467	840			794	74	946	1,020	1,610
	P 97	754	28	246	274	580		S 45	795	98	1,246	1,344	2,160
		755	34	424	458	710			796	99	1,251	1,350	2,170
		756	40	481	521	1,000			797	58	786	798	1,250
	P 84	757	50	604	654	1,010			798	48	615	663	1,830
		758	29	334	383	1,420			799	89	1,131	1,220	1,960
		759	48	532	572	1,310			800	81	1,013	1,094	1,760
	P 85	760	43	637	685	1,060		P 86	801	53	665	718	1,160
		761	97	1,331	1,428	2,260			802	789	729	787	2,270
		762	30	709	739	2,730			803	91	1,058	1,143	1,840
	P 86	763	83	1,134	1,217	1,320			804	85	1,132	1,223	1,970
		764	108	1,475	1,583	2,180			805	90	1,042	1,132	1,920
		765	183	1,778	1,846	3,310			806	22	1,482	1,611	2,660
	P 757	766	199	1,835	1,846	3,980			807	30	792	822	1,350
		767	155	2,064	2,219	3,980			808	15	388	403	650
		768	90	253	279	1,030			809	19	178	197	320
		769	127	1,683	1,810	3,240			810	24	225	249	400

103

P 121 & 193 S 122 S 224	797	31	290	321	880	520	Lackawanna -----	P 32	849	60	928	988	3,700	1,520
	195	4	152	156	420	250		850	48	786	784	2,940	1,210	
	798	5	47	52	140	80		210	32	194	226	850	580	
	799	27	246	273	750	440		211	48	295	343	1,290	530	
	800	43	401	444	1,220	720		851	28	169	197	740	300	
	801	51	470	521	1,430	840		212	626	3,888	4,514	10,790	7,500	
	802	61	564	625	1,720	1,010		852	719	4,354	5,173	19,400	8,600	
	803	70	653	723	1,890	1,160		48	213	1,887	2,251	8,440	3,740	
	804	8	71	79	220	130		213	121	904	1,025	3,840	1,700	
	805	14	127	141	390	230		585	585	3,025	3,610	13,540	6,000	
S 264	806	7	66	73	200	120	854	566	2,990	3,496	13,110	5,810		
	807	6	60	66	180	110	855	348	1,803	2,151	8,070	3,580		
	808	19	178	197	540	320	49	313	2,882	3,195	8,790	5,310		
	809	29	268	297	820	480	276	273	2,739	3,115	11,680	5,180		
	810	22	208	230	630	370	856	275	2,585	2,810	10,540	4,670		
	811	16	148	164	450	260	857	140	1,884	2,024	7,590	3,360		
	812	106	931	1,037	2,840	1,760	947	70	1,017	1,581	3,810	1,660		
	813	47	495	542	1,460	920	858	109	1,472	1,581	5,930	2,630		
	814	35	372	407	1,100	690	859	111	1,540	1,676	2,540	1,150		
	815	21	212	233	630	360	860	43	525	566	2,460	1,090		
P 37 & 224 P 37 S 38 P 39 P 192	816	31	570	601	1,620	1,020	Lancaster -----	S 335	861	54	928	371	1,390	960
	817	20	360	380	1,030	650		P 51	196	1,891	2,187	6,010	3,580	
	198	18	174	182	520	300		862	184	1,866	2,049	5,640	3,310	
	816	17	163	180	430	250		863	172	1,739	1,911	5,260	3,090	
	817	12	124	134	360	210		864	184	1,962	2,156	5,930	3,480	
	199	24	134	158	430	250		865	283	2,959	3,252	8,940	5,260	
	200	32	268	300	810	490		S	866	70	710	790	1,260	
	818	43	361	404	1,090	660		216	120	1,657	1,777	4,890	2,870	
	819	30	247	277	750	450		867	147	2,015	2,162	5,950	3,490	
	201	48	512	560	1,510	910		868	132	1,816	1,948	5,360	3,150	
S 111 P 208	820	49	519	568	1,530	930	869	108	1,474	1,582	4,350	2,560		
	45	118	916	1,034	2,790	1,690	870	101	1,385	1,486	4,090	2,400		
	821	79	611	690	1,890	1,130	871	125	1,706	1,831	5,040	2,960		
	822	132	1,023	1,155	3,120	1,890	872	118	1,621	1,739	4,780	2,810		
	202	12	222	234	630	380	873	161	2,204	2,365	6,500	3,890		
	46	98	1,074	1,172	3,160	1,980	874	13	1,119	1,182	3,960	2,480		
	823	72	791	863	2,330	1,390	875	102	1,046	1,065	2,880	1,690		
	824	24	239	263	710	420	876	124	1,141	1,265	3,480	2,040		
	825	38	378	416	1,120	670	877	74	685	759	2,090	1,250		
	P 203	108	1,362	1,470	5,440	2,500	878	98	457	485	1,380	780		
S 56 P 121 P 192 S 261 S 346 S 352 P 63	S 204	62	813	875	2,340	1,410	879	34	546	580	1,620	940		
	826	53	634	707	2,630	1,440	880	45	739	784	2,160	1,270		
	P 827	64	783	847	3,130	1,440	881	721	798	802	2,210	1,280		
	828	120	1,477	1,597	5,910	2,720	882	220	81	802	2,270	1,300		
	829	26	339	365	1,350	590	883	81	717	798	2,290	1,290		
	830	60	603	663	1,780	1,060	884	84	751	835	2,300	1,350		
	831	60	603	663	1,780	1,060	885	94	882	926	2,550	1,500		
	832	12	159	171	630	280	886	147	1,310	1,457	4,010	2,360		
	833	22	284	329	850	370	887	104	960	1,064	2,930	1,720		
	834	16	213	229	740	400	888	19	179	198	540	320		
Indiana -----	835	34	550	584	1,580	1,010	889	26	244	270	740	440		
	836	10	156	166	450	560	890	26	244	270	740	440		
	837	23	373	396	1,070	690	891	97	1,195	1,292	3,550	2,050		
	47	94	1,087	1,181	3,190	2,050	892	85	901	936	2,710	1,590		
	206	68	824	892	2,410	1,550	893	77	879	956	2,630	1,540		
	838	95	1,087	1,182	3,190	2,010	894	69	783	852	2,340	1,380		
	839	62	708	770	2,080	1,340	895	96	1,095	1,191	3,280	1,920		
	P 293	27	273	300	810	720	896	96	1,446	1,573	4,380	2,540		
	S 228	20	538	568	1,530	960	897	127	1,479	1,609	4,420	2,600		
	841	18	319	337	810	580	898	130	1,479	1,609	4,420	2,600		
Jefferson -----	842	48	386	416	1,650	900	899	79	963	981	2,700	1,580		
	208	48	386	416	1,650	900	900	69	783	852	2,340	1,380		
	843	91	1,135	1,228	4,540	1,910	901	83	1,582	1,665	4,580	2,690		
	844	39	697	736	2,720	1,510	902	96	1,814	1,910	5,250	3,090		
	P 60	63	843	931	2,700	1,440	903	85	1,608	1,693	4,660	2,740		
	S 63	20	258	278	1,030	430	904	19	363	382	1,050	630		
	S 64	39	799	838	3,100	1,310	905	65	532	598	1,640	970		
	P 338	26	238	264	980	2,090	906	46	366	411	1,130	660		
	P 31	54	437	491	1,840	760	907	58	465	523	1,440	840		
	848	92	748	840	3,150	1,290	908	39	300	399	1,100	640		
Junlata -----														

HIGHWAY TRANSPORTATION SURVEY

MOTOR VEHICLE TRAFFIC AT TRANSPORT SURVEY STATIONS—Continued

County	Route no.	(New) Station No.	Average daily number of motor vehicles—1924			Forecast of average daily traffic 1930	County	Route no.	(New) Station No.	Average daily number of motor vehicles—1924			Forecast of average daily traffic 1930
			Trucks	Passen- gercars	Total					Trucks	Passen- gercars	Total	
Lawrence	S 332 S 344 P 77 P 80 P 81 S 233 S 246 S 265 S 315 S 137 S 138 P 133 S 140 S 141 P 149 S 280 S 280 P 153 P 157 S 158 P 163	901	21	192	213	340	Luzerne	S 226 S 297 P 4 P 5 S 11 P 169 P 170 S 177 S 184 P 185 P 232 S 327 S 361 P 368 P 18 P 18 P 19 20 P 21 P 23 S 176 S 239 S 240	943	133	1,212	1,345	2,360
		902	32	299	331	540			944	129	1,178	1,307	2,390
		903	84	777	861	1,390			235	42	372	414	720
		904	63	583	646	1,040			945	47	414	461	810
		905	68	626	694	1,120			236	91	700	791	1,380
		906	43	400	443	1,220			946	115	886	1,001	1,750
		907	20	182	202	330			237	390	2,282	2,672	4,510
		908	31	286	317	510			56	137	800	937	1,550
		223	82	1,378	1,460	2,540			947	124	727	851	1,550
		909	52	885	937	1,630			948	179	1,049	1,228	2,070
		910	64	1,080	1,144	1,890			949	179	1,049	1,228	2,070
		224	136	1,571	1,707	2,970			950	419	2,448	2,867	4,810
		911	133	1,525	1,658	2,880			237	545	3,472	4,017	15,060
Lebanon	S 137 S 138 P 133 S 140 S 141 P 149 S 280 S 280 P 153 P 157 S 158 P 163	912	82	947	1,029	1,790	Lycoming	S 177 S 184 P 185 P 232 S 327 S 361 P 368 P 18 P 18 P 19 20 P 21 P 23 S 176 S 239 S 240	951	545	3,375	3,920	6,780
		53	106	1,438	1,544	2,680			952	323	2,000	2,323	8,710
		913	107	1,450	1,557	2,710			238	430	3,062	3,492	5,890
		914	73	1,064	1,137	2,100			953	391	2,754	3,175	5,360
		225	123	1,290	1,413	2,460			239	26	403	429	1,610
		915	19	244	263	460			954	15	238	253	950
		916	36	466	502	870			955	74	1,131	1,205	4,520
		54	70	872	942	1,640			956	93	946	1,042	3,910
		917	101	1,261	1,362	2,370			957	93	946	1,042	3,910
		918	76	956	1,032	1,790			958	75	725	765	2,870
		216	77	604	681	1,110			959	94	919	1,013	3,800
		919	136	1,066	1,202	1,960			960	53	511	564	2,120
		920	130	1,020	1,150	1,870			241	128	806	934	3,500
		921	61	544	605	980			961	97	610	707	2,650
Lehigh	S 280 S 280 P 153 P 157 S 158 P 163	227	203	2,002	2,205	3,590	Lycoming	S 177 S 184 P 185 P 232 S 327 S 361 P 368 P 18 P 18 P 19 20 P 21 P 23 S 176 S 239 S 240	962	108	942	1,050	3,940
		922	182	1,792	1,974	3,210			963	93	578	631	2,780
		923	177	1,743	1,920	3,130			964	102	689	741	2,780
		924	46	428	474	770			965	36	353	389	660
		925	25	227	252	410			966	58	2,743	3,121	5,270
		926	36	331	367	600			967	58	2,743	3,121	5,270
		927	34	314	348	570			968	100	1,108	1,208	4,580
		228	51	417	468	760			969	208	2,284	2,492	9,340
		928	76	623	699	1,140			970	200	2,206	2,406	9,030
		929	72	589	661	1,080			971	193	2,132	2,325	8,720
		930	41	337	378	620			972	90	956	1,046	3,920
		229	183	1,454	1,637	2,660			973	144	1,533	1,677	6,290
		931	136	1,414	1,550	2,520			974	92	974	1,066	4,000
		932	121	1,253	1,374	2,240			975	90	208	228	860
		933	108	1,124	1,232	2,010			976	78	1,016	1,073	4,020

McKean	S 240	985	69	738	2,770	1,180	Monroe	P 1,039	60	774	834	3,130	1,400
	S 266	986	44	475	1,750	700		261	20	261	281	1,050	470
	S 289	987	29	310	1,160	500		1,040	63	776	889	3,150	1,410
	S 291	988	11	315	1,430	180		262	67	647	714	2,650	1,200
	S 303	989	2	22	80	40		1,041	96	578	674	2,530	1,640
	S 321	990	11	114	430	180		263	94	568	659	2,470	1,610
	S 331	991	21	202	223	380		1,042	57	555	615	2,810	1,000
	S 353	992	4	35	150	60		264	138	1,825	1,961	7,350	2,380
	P 95	993	14	133	147	240		265	130	1,240	1,370	5,140	2,250
	P 96	994	12	117	129	210		1,043	37	545	582	2,180	1,310
Mercer	S 97	995	9	88	97	360	Montgomery	1,044	41	729	806	3,020	1,310
	P 100	996	30	498	538	1,950		266	67	1,170	1,237	4,640	2,010
	P 101	997	25	503	533	850		267	171	1,791	1,962	7,860	3,190
	S 210	998	38	320	345	550		1,045	105	1,102	1,207	4,530	1,960
	S 211	999	24	1,191	1,261	2,010		1,046	71	748	819	3,670	1,330
	P 73	1,000	74	1,320	4,850	2,100		1,047	20	194	214	800	350
	S 74	1,001	27	1,940	840	780		1,049	59	679	638	2,300	1,040
	P 219	1,002	475	1,760	760	1,050		268	10	97	107	400	170
	S 80	1,003	76	1,700	730	1,380		1,051	776	6,153	6,929	19,060	11,870
	P 82	1,004	866	3,200	1,340	1,440		1,052	140	987	1,127	3,100	1,930
Mifflin	P 238-320	1,005	903	3,340	2,080	2,140	Mifflin	1,053	156	1,106	1,262	3,470	2,160
	S 213	1,006	455	1,680	1,450	1,500		1,054	124	935	1,059	2,910	1,810
	P 238	1,007	314	1,600	1,500	1,500		1,055	169	1,277	1,446	3,980	2,480
	S 246	1,008	201	740	320	320		1,056	99	744	843	2,920	1,440
	S 312	1,009	484	1,790	770	770		1,057	125	1,082	1,214	3,840	2,080
	P 320	1,010	453	1,790	770	770		1,058	253	1,684	1,917	5,270	3,280
	P 28	1,011	322	1,190	510	1,280		1,059	266	1,751	2,017	5,550	3,470
	P 29	1,012	318	1,180	1,280	1,280		1,060	130	1,136	1,266	3,480	2,170
	P 32	1,013	661	2,450	2,080	2,140		1,061	186	1,621	1,807	4,970	3,100
	33	1,014	1,173	4,340	2,140	2,140		1,062	329	2,908	3,237	8,900	5,640

HIGHWAY TRANSPORTATION SURVEY

MOTOR VEHICLE TRAFFIC AT TRANSPORT SURVEY STATIONS—Continued

County	Route no.	(New) Station No.	Average daily number of motor vehicles—1924			Forecast of average daily traffic 1930	County	Route no.	(New) Station No.	Average daily number of motor vehicles—1924			Forecast of average daily traffic 1930
			Trucks	Passenger cars	Total					Trucks	Passenger cars	Total	
Montour	C. R. C. R. P. 2 P. 3 S 240-259 P 156 P 159	1,090	33	263	301	520	Pike	S 293	1,131	41	383	424	640
		1,350	274	1,582	1,856	3,180			1,132	54	496	550	1,170
		1,351	372	3,446	3,818	5,900			1,133	48	442	490	1,510
		1,091	44	592	636	1,440			1,287	36	290	326	1,350
		1,092	75	901	976	1,660			1,184	18	143	161	1,220
	165	1,276	104	654	758	1,550	Potter	S 100 P 101 P 102	68	60	910	970	3,640
		1,093	68	429	497	1,860			1,135	45	687	732	3,640
		66	142	1,579	1,721	2,980			288	26	470	496	2,740
		1,094	334	3,090	3,424	4,920			1,136	26	472	498	1,870
		P 1,095	165	1,623	1,693	2,930			1,137	26	471	497	1,860
Northampton	166	1,096	175	1,632	1,798	3,110	Schuylkill	S 318 140	1,138	8	104	112	1,410
		1,097	166	1,532	1,698	2,940			1,139	22	314	336	1,240
		S 1,098	117	1,083	1,200	2,000			1,140	18	259	277	1,020
		P 1,099	105	968	1,073	2,950			1,141	15	232	247	910
		P 1,100	176	1,636	1,812	4,980			1,142	10	157	167	630
	S 175 & 297 S 175	P 1,101	180	1,673	1,853	3,200			1,143	16	242	258	960
		S 1,102	114	1,051	1,165	3,200			1,144	5	80	85	310
		1,103	98	904	1,002	2,760			1,145	7	98	105	390
		1,104	119	1,097	1,216	3,340			1,146	5	58	63	230
		277	186	1,460	1,646	4,530			1,147	11	148	159	590
Northumberland	S 297 S 1 P 2 P 18	1,105	154	1,210	1,364	3,750	Snyder	P 162	1,148	5	62	67	250
		1,106	52	408	460	800			1,149	9	112	121	450
		1,107	52	481	533	1,470			P 69	298	2,430	2,728	7,500
		1,108	24	223	247	680			S 1,150	71	583	654	4,410
		1,109	148	1,160	1,308	3,600			P 1,151	276	2,257	2,533	1,800
	P 161	1,110	18	173	191	720	Perry	P 191 P 199	1,152	122	1,001	1,123	8,090
		1,111	42	794	836	1,700			1,153	217	1,777	1,994	5,450
		279	68	1,668	1,786	6,700			1,154	161	1,230	1,391	5,820
		1,112	75	1,062	1,137	4,260			1,155	151	1,147	1,298	3,570
		1,113	120	1,695	1,815	6,810			1,156	124	942	1,066	4,000
Perry	S 240 S 283 S 336 P 30 & 40 S 30	67	356	2,078	2,434	9,130	Snyder	P 185 & 290 P 191 P 199	1,157	161	1,229	1,390	3,820
		281	130	1,305	1,435	5,380			1,158	146	1,115	1,261	4,730
		1,114	248	1,451	1,699	6,370			70	146	1,064	1,210	3,330
		1,115	595	3,483	4,078	15,290			1,159	247	1,797	2,044	5,620
		1,116	236	1,381	1,617	6,090			1,160	244	1,770	2,014	5,620
	P 31 P 31-191 & 293 P 31 S 122 P 195	1,117	45	443	488	1,890			1,161	294	1,634	1,848	5,090
		1,118	60	583	643	2,410			1,162	129	1,009	1,148	3,160
		1,119	33	321	354	2,130			1,163	186	1,348	1,534	5,750
		282	32	344	376	1,030			1,164	163	1,186	1,349	3,710
		1,120	33	351	384	1,060			1,165	154	1,115	1,269	4,760
Perry	P 31 P 31-191 & 293 P 31 S 122 P 195	1,121	51	547	598	1,640	Snyder	P 25	291	92	798	890	2,450
		1,122	35	377	412	1,130			292	132	1,004	1,136	3,120
		1,123	34	371	405	620			293	198	1,236	1,434	3,940
		283	35	287	322	890			1,166	164	1,025	1,189	3,270
		284	65	773	838	2,300			1,167	263	1,642	1,905	5,240
	S 122 P 195	1,124	67	548	615	1,690			1,168	83	720	803	3,010
		1,125	61	500	561	1,540			1,169	180	1,648	1,887	5,240
		285	26	347	373	1,030			1,170	122	1,062	1,184	4,440
		286	44	1,073	1,117	3,070			1,171	56	515	571	1,570
		1,126	46	1,141	1,187	3,260			71	132	1,572	1,704	6,390
Perry	S 122 P 195	1,127	38	957	996	2,740	Snyder	P 28	294	43	441	484	1,820
		1,128	23	578	601	1,650			1,172	122	1,456	1,578	5,920
		1,129	22	537	559	1,540			1,173	64	658	722	2,710
		1,130	22	549	571	1,570			1,174	43	438	481	1,900
									1,175	15	151	166	620
	S 122 P 195												

Somerst	(Detour)	1,176	42	404	446	1,670	710	S 103	307	43	255	298	1,120	420
	S 194	1,177	30	288	318	1,190	510		1,230	34	330	364	1,360	520
	(Detour)	1,178	82	979	1,061	3,650	1,600		1,231	19	185	204	760	290
	S 195	1,179	74	883	967	3,650	1,620		1,232	47	452	499	1,870	710
	P 229	1,180	22	818	840	2,270	1,460		1,233	15	149	164	620	230
	P 50	1,181	71	711	782	2,150	1,350		1,234	10	92	102	380	140
	P 51	1,182	37	436	473	1,230	820		1,235	6	62	68	260	100
	P 51	1,183	58	906	964	2,600	1,670		1,236	83	1,192	1,275	4,780	2,150
	P 51	1,184	41	647	683	1,860	1,190		1,237	25	581	606	2,270	1,020
	P 51	1,185	52	813	865	2,380	1,500		1,238	48	1,104	1,152	4,320	1,950
Sullivan	P 51	1,186	58	906	964	2,600	1,670	S 106	1,239	9	86	95	360	210
	S 52	1,187	34	398	432	1,560	980		1,240	5	53	58	220	80
	P 51	1,188	52	813	865	2,380	1,500		1,241	19	181	200	750	280
	S 52	1,189	34	398	432	1,560	980		1,242	29	283	312	1,170	410
	P 119	1,190	35	346	381	1,950	660		1,243	120	1,108	1,228	4,600	1,910
	S 186	1,191	63	633	686	1,910	1,200		1,244	138	1,269	1,407	5,280	2,180
	S 222	1,192	70	382	452	1,240	780		1,245	5	48	53	200	80
	P 269	1,193	118	648	766	2,110	1,330		1,246	69	839	968	3,580	1,570
	P 317	1,194	52	922	974	2,630	1,690		1,247	310	58	904	3,620	1,560
	P 317	1,195	49	878	927	2,550	1,610		1,248	310	58	904	3,620	1,560
Susquehanna	P 17	1,196	43	775	818	1,910	1,200	S 207	1,249	24	387	396	1,460	650
	P 17	1,197	57	1,014	1,071	2,940	1,860		1,250	68	842	910	3,370	1,430
	P 17	1,198	54	856	1,010	2,780	1,760		1,251	99	1,259	1,398	5,170	2,270
	P 17	1,199	33	328	361	960	620		1,252	62	379	441	1,630	730
	P 17	1,200	26	264	290	800	500		1,253	114	1,637	1,801	6,660	2,970
	P 17	1,201	47	575	622	1,710	1,080		1,254	128	1,203	1,331	4,920	2,160
	P 17	1,202	66	912	978	2,640	1,680		1,255	179	1,160	1,339	4,950	2,175
	P 17	1,203	64	885	1,117	3,290	2,070		1,256	35	425	460	1,700	750
	P 17	1,204	113	1,318	1,431	3,890	2,480		1,257	49	600	649	2,400	1,050
	P 17	1,205	105	1,222	1,327	3,650	2,300		1,258	314	32	969	1,001	3,700
Tioga	P 17	1,206	101	1,877	2,038	5,600	3,530	S 218 & 233	1,259	27	803	883	3,080	1,350
	P 17	1,207	19	189	208	780	290		1,260	24	696	720	2,630	1,170
	P 17	1,208	29	277	306	1,150	330		1,261	44	1,287	1,331	4,920	2,160
	P 17	1,209	7	71	78	230	110		1,262	79	899	978	3,630	1,560
	P 17	1,210	22	216	238	880	330		1,263	17	105	212	780	670
	P 17	1,211	81	790	871	3,270	1,450		1,264	70	894	973	3,600	1,540
	P 17	1,212	38	368	406	1,520	640		1,265	132	1,754	1,886	6,980	2,790
	P 17	1,213	27	487	514	1,930	870		1,266	31	460	491	1,820	780
	P 17	1,214	17	309	326	1,220	510		1,267	28	280	301	1,110	480
	P 17	1,215	22	403	425	1,560	670		1,268	23	408	436	1,610	690

MOTOR VEHICLE TRAFFIC AT TRANSPORT SURVEY STATIONS—Continued

County	Route no.	(New) Station No.	Average daily number of motor vehicles—1924			Forecast of average daily traffic 1930	County	Route no.	(New) Station No.	Average daily number of motor vehicles—1924			Forecast of average daily traffic 1930
			Trucks	Passenger cars	Total					Trucks	Passenger cars	Total	
Westmoreland	P 7 & 335	325	72	755	827	3,100		S 124	1,310	80	732	812	1,320
	P 7	1,278	74	778	852	3,200			1,311	123	1,117	1,240	2,230
	S 171	326	10	79	89	330			1,312	115	1,044	1,159	3,410
		1,279	8	83	91	340			1,313	169	1,722	1,911	1,880
	S 172 & 335	327	35	268	303	1,140		S 125	1,314	21	190	211	3,110
	S 173	328	44	325	369	1,380		P 126	1,340	186	2,335	2,521	580
		1,280	36	268	304	1,140			1,315	137	1,712	1,849	6,880
	S 254	1,281	30	291	321	1,200			1,316	216	2,698	2,914	5,080
	P 335	1,282	12	58	70	260		P 127	1,316	161	1,108	1,269	8,010
		1,282	53	319	352	1,320			1,341	56	608	664	3,480
	P 68	330	144	1,136	1,280	3,400			1,317	293	2,664	2,957	1,550
		1,283	28	614	642	1,730			1,318	144	1,310	1,454	8,130
		1,284	23	490	513	1,380			1,319	73	661	734	4,810
		331	61	833	894	2,300		P 128	1,319	156	1,961	2,117	2,360
	S 69	332	63	1,086	1,149	2,410			1,320	244	3,053	3,297	1,130
		1,285	68	1,167	1,235	3,330			1,321	159	1,983	2,142	5,860
		1,286	48	818	866	2,340		S 190	1,322	123	1,542	1,665	3,450
		1,287	53	903	956	2,580			1,343	65	415	480	5,360
		1,288	61	832	893	2,410			1,323	12	113	125	4,580
	P 117	333	92	896	988	2,670			1,324	8	77	85	2,710
Wyoming	S 118	334	40	545	585	1,580			1,325	140	899	1,039	840
		1,290	44	656	700	1,580			1,326	95	610	689	1,690
	S 118	1,291	53	732	785	2,120		S 216	1,327	41	262	303	1,940
		1,292	42	580	622	1,680			1,327	246	1,169	1,414	1,150
	P 119	336	36	491	527	1,420		S 216	1,328	25	91	116	3,800
		1,293	136	2,086	2,222	6,000			1,329	379	1,797	2,176	320
		1,294	65	1,004	1,069	2,890			1,329	248	1,175	1,423	5,980
	P 120	1,295	82	1,268	1,350	3,640			1,330	309	1,467	1,776	3,910
		1,296	136	1,943	2,079	5,530			1,331	61	569	630	2,880
		1,297	132	2,098	2,230	6,000			1,332	16	151	167	1,730
		1,298	255	2,491	2,746	7,410		S 220	1,333	71	659	730	1,460
	S 186	338	69	694	763	2,060			1,333	16	151	167	2,010
	P 187	1,299	70	548	618	1,670			1,334	77	617	684	1,510
	S 188	1,300	84	888	972	2,490			1,335	67	617	684	1,280
	S 288	1,301	9	90	99	270			1,336	119	1,099	1,218	1,880
	P 9	1,302	132	1,288	1,420	5,370		250	1,337	64	745	809	1,890
	S 11	1,303	17	116	128	480			P 346	126	1,258	1,384	2,220
	S 13	1,304	12	116	128	480			S 347	213	2,128	2,341	1,820
	P 232	1,305	10	93	103	330			1,338	105	1,053	1,158	2,250
	P 241	1,306	11	100	111	400			1,339	50	501	551	6,440
	P 123	1,307	50	1,195	1,245	3,470		S 332	1,340	52	520	572	3,180
York		1,308	36	875	911	2,540			1,341	52	520	572	900
	S 124	1,309	109	988	1,097	3,020			1,342	70	97	107	1,570
			72	656	728	2,000			1,343	80	743	823	2,990
									P 1,344	38	442	480	1,700

APPENDIX III

Average Daily Density of Loaded and Empty Truck Traffic by Capacity Groups

Station	Average daily trucks			Average daily trucks by capacity groups									
				$\frac{1}{2}$ -1½ tons		2-2½ tons		3-4 tons		5-5½ tons		6-7½ tons	
	Total	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty
1	457	301	156	181	100	64	24	30	18	25	14	1	-----
2	166	108	68	61	34	16	12	15	10	11	7	-----	-----
3	368	228	140	134	90	56	24	24	19	14	7	-----	-----
4	275	163	112	101	63	35	24	16	14	11	11	-----	-----
5	234	135	99	67	46	37	28	11	9	20	16	-----	-----
6	180	86	44	57	29	16	7	7	5	6	3	-----	-----
7	320	190	130	108	78	43	24	19	13	19	14	1	1
8	70	46	24	26	16	12	4	5	3	3	1	-----	-----
9	32	19	13	13	8	3	3	2	1	1	1	-----	-----
10	40	21	19	9	7	3	2	5	6	4	4	-----	-----
11	372	240	132	148	82	46	26	30	16	16	8	-----	-----
12	84	54	30	40	18	9	6	4	5	1	1	-----	-----
13	183	127	56	79	35	19	10	16	7	12	4	1	-----
14	102	73	29	47	18	10	5	7	4	6	2	3	-----
15	268	171	97	119	62	21	11	17	12	14	12	-----	-----
16	98	64	34	49	26	7	3	7	4	1	1	-----	-----
17	126	82	44	65	35	11	5	5	3	1	1	-----	-----
18	70	39	31	29	25	6	4	3	1	1	1	-----	-----
19	134	91	43	59	29	14	7	9	4	9	3	-----	-----
20	65	43	22	29	15	7	4	4	2	3	1	-----	-----
21	888	537	351	227	142	80	49	80	56	143	99	7	5
22	144	83	61	51	33	14	12	9	8	9	8	-----	-----
23	46	31	15	18	9	6	3	6	2	1	1	-----	-----
24	343	234	109	108	56	48	18	31	13	45	21	2	1
25	66	43	23	30	17	7	3	4	2	2	1	-----	-----
26	154	91	63	58	36	28	23	5	4	-----	-----	-----	-----
27	138	87	51	69	40	13	8	5	3	-----	-----	-----	-----
28	94	57	37	46	29	9	7	2	1	-----	-----	-----	-----
29	147	97	50	78	38	12	5	3	3	4	4	-----	-----
30	909	590	318	402	224	131	56	47	33	9	5	1	-----
31	352	213	139	118	69	26	12	57	48	12	11	-----	-----
32	232	157	75	103	49	27	12	18	9	9	5	-----	-----
33	135	92	43	64	31	15	5	9	5	3	2	1	-----
34	762	474	288	283	173	82	49	53	29	55	36	1	1
35	534	356	178	199	98	53	28	42	21	61	30	1	1
36	536	333	203	217	120	67	33	28	21	30	28	1	1
37	97	69	28	57	25	10	2	2	1	-----	-----	-----	-----
38	129	85	44	65	33	12	7	4	2	4	2	-----	-----
39	180	123	57	106	48	11	5	4	3	2	1	-----	-----
40	171	94	77	57	44	22	18	13	14	2	1	-----	-----
41	106	69	37	50	26	12	7	5	3	2	1	-----	-----
42	163	96	72	62	44	22	15	11	11	1	2	-----	-----
43	106	61	45	41	29	13	10	6	5	1	1	-----	-----
44	90	57	33	40	21	7	4	4	3	5	4	1	1
45	118	65	53	33	24	13	11	10	9	9	9	-----	-----
46	98	68	30	53	19	7	5	7	5	1	1	-----	-----
47	94	53	41	40	31	11	8	2	2	-----	-----	-----	-----
48	364	260	104	204	81	29	11	22	10	5	2	-----	-----
49	313	213	100	164	73	28	17	15	8	6	2	-----	-----
50	140	93	47	66	33	10	5	12	7	5	2	-----	-----
51	196	123	73	65	39	23	11	19	12	15	10	1	1
52	85	55	30	36	19	9	4	7	5	3	2	-----	-----
53	106	73	33	53	26	12	4	5	2	3	1	-----	-----
54	70	45	25	38	19	5	3	3	3	-----	-----	-----	-----
55	183	119	64	77	44	17	9	10	4	14	7	1	-----
56	390	257	133	183	76	33	21	30	27	11	9	-----	-----
57	96	62	34	42	21	10	7	7	5	3	1	-----	-----
58	378	242	136	177	101	39	20	21	10	5	4	1	1
59	209	133	75	107	60	20	11	5	3	1	1	-----	-----
60	76	48	28	37	23	6	3	4	2	1	-----	-----	-----
61	164	109	55	91	43	11	8	8	3	2	1	-----	-----
62	124	87	37	47	21	20	9	8	3	12	4	-----	-----
63	329	225	104	140	66	39	17	23	10	22	11	1	-----
64	122	86	36	51	18	14	8	8	4	13	6	-----	-----
65	142	97	45	63	29	16	7	7	4	10	5	1	-----
66	260	182	78	114	48	38	14	16	7	13	9	1	-----
67	356	218	138	181	102	24	18	11	15	2	2	-----	1
68	60	37	23	30	19	5	2	1	1	1	1	-----	-----
69	298	202	96	153	66	26	16	18	11	5	3	-----	-----

HIGHWAY TRANSPORTATION SURVEY

Average Daily Density of Loaded and Empty Truck Traffic by Capacity Groups—Continued

Station	Average daily trucks			Average daily trucks by capacity groups									
				$\frac{1}{2}$ -1½ tons		2-2½ tons		3-4 tons		5-5½ tons		6-7½ tons	
	Total	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty
70	146	101	45	78	34	13	6	7	3	8	2		
71	132	90	42	73	34	9	4	5	3	3	1		
72	113	73	40	49	26	16	10	6	4	2			
73	60	40	20	31	16	5	2	3	2	1			
74	68	44	24	38	22	4	1	1		1	1		
75	178	104	74	90	59	12	12	1	3	1			
76	70	42	28	25	16	9	7	5	3	3	2		
77	90	57	33	38	22	11	6	5	3	3	2		
78	144	83	61	67	49	9	8	5	3	2	1		
79	156	103	48	65	31	19	6	14	7	10	4		
80	35	23	12	16	8	4	2	3	2				
81	78	45	33	26	15	7	8	8	9	4	3		
82	52	37	15	28	10	6	8	2	1	1	1		
83	37	22	15	12	7	3	2	2	1	5	5		
84	33	24	9	16	7	5	1	2	1	1			
85	60	39	21	25	14	8	3	4	3	2	1		
86	35	21	14	16	10	3	3	2	1				
87	67	43	24	24	11	7	3	4	3	8	7		
88	417	231	186	131	109	56	47	23	18	20	12	1	
89	83	48	35	25	16	8	6	4	4	11	9		
90	75	41	34	18	16	11	9	7	2	5	3		
91	52	30	22	21	16	7							
92	102	55	47	31	27	13	11	5	4	6	5		
93	88	47	36	28	22	9	6	4	3	6	5		
94	18	9	9	4	4	2	3	3	2				
95	30	20	10	16	8	2	1	1		1	1		
96	20	11	9	8	7	2	2	1					
97	60	38	22	25	11	6	6	5	4	2	1		
98	181	105	76	69	49	13	9	10	9	12	9	1	
99	276	147	129	84	86	39	24	17	13	7	6		
100	270	157	113	105	77	26	16	17	15	8	5	1	
101	135	75	60	44	39	9	7	11	10	3	2		
102	42	22	20	17	16	3	1	2	2		1		
103	46	25	21	19	17	4	2	1			1		
104	144	84	60	63	44	11	8	6	5	1	3	1	
105	236	133	112	121	76	30	13	22	13	9	8	1	2
106	54	36	18	28	13	2	2	4	2	2	1		
107	208	109	99	61	56	28	26	16	14	4	3		
108	88	58	30	42	25	7	3	9	2				
109	28	20	8	18	7	2	1						
110	64	40	24	36	20	2	2	2	2				
111	35	26	9	20	7	2	1	4	1				
112	26	16	10	14	9	2	1						
113	24	19	5	16	4	2	1	1					
114	20	16	4	12	3	2			1				
115	73	48	25	42	22	4	1	2	2				
116	40	28	12	20	10	7	1	1	1				
117	193	130	63	87	43	22	11	13	5	8	4		
118	134	89	45	56	30	14	6	8	5	10	4	1	
119	43	32	16	23	10	6	2	3	4	1			
120	134	88	46	47	21	14	7	13	10	14	8		
121	40	23	12	17	7	4	2	2	1	5	2		
122	59	40	19	29	13	5	2	3	3	3	1		
123	160	100	60	73	47	9	5	10	5	7	3	1	
124	336	225	111	91	49	37	18	31	16	60	27	6	1
125	77	46	31	28	19	8	7	4	2	6	3		
126	79	49	30	37	21	6	6	3	2	2	1	1	
127	35	18	17	13	13	3	3	1	1	1			
128	50	29	21	23	16	4	4	2	1				
129	90	55	35	40	23	9	8	5	4	1			
130	122	70	52	54	39	10	8	4	4	2	1		
131	59	39	20	33	15	5	3	1	2				
132	33	20	13	17	10	2	2	1	1				
133	81	51	30	40	22	8	6	3	2				
134	12	5	7	2	5	3	2						
135	119	68	51	50	41	14	6	4	4				
136	164	98	66	83	53	10	7	4	2	1	1		
137	40	22	18	15	12	3	2	3	3	1	1		
138	94	58	36	46	28	10	6	1	1	1	1		
139	46	32	14	26	10	5	4	1					
140	34	19	15	17	15	2							
141	56	32	24	22	15	9		1					
142	15	10	5	8	4	1				1			
143	199	129	70	89	52	21	9	11	5	9	4		
144	70	50	20	27	13	7	3	5	1	10	3	1	
145	198	129	69	61	36	25	11	19	9	22	13	2	
146	126	80	46	42	26	14	7	9	5	14	7	1	1

Average Daily Density of Loaded and Empty Truck Traffic by Capacity Groups—Continued

Station	Average daily trucks			Average daily trucks by capacity groups									
				$\frac{1}{2}$ -1½ tons		2-2½ tons		3-4 tons		5-5½ tons		6-7½ tons	
	Total	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty
147	262	180	82	83	42	31	13	24	11	41	16	1	-----
148	100	66	34	42	21	10	4	8	4	6	5	-----	-----
149	32	18	14	14	9	3	3	1	1	-----	1	-----	-----
150	44	24	20	19	14	4	4	1	2	-----	-----	-----	-----
151	40	20	20	14	15	5	4	1	1	-----	-----	-----	-----
152	15	8	7	8	6	-----	-----	-----	-----	-----	-----	-----	-----
153	94	60	34	46	27	12	6	2	1	-----	-----	-----	-----
154	76	42	34	35	28	6	5	1	1	-----	-----	-----	-----
155	10	6	4	5	3	1	1	-----	-----	-----	-----	-----	-----
156	33	23	10	18	10	6	-----	-----	-----	-----	-----	-----	-----
157	88	51	37	43	31	7	5	1	1	-----	-----	-----	-----
158	102	62	40	51	31	9	8	1	1	1	-----	-----	-----
159	94	61	33	49	27	9	4	2	1	1	1	-----	-----
160	178	102	76	76	57	17	11	8	7	1	1	-----	-----
161	53	36	17	31	15	2	2	3	-----	-----	-----	-----	-----
162	27	14	13	12	10	1	2	1	1	-----	-----	-----	-----
163	51	27	24	18	15	4	3	4	5	1	1	-----	-----
164	44	27	17	22	13	3	2	1	1	1	1	-----	-----
165	31	22	9	20	9	2	-----	-----	-----	-----	-----	-----	-----
166	26	14	12	12	8	2	2	-----	1	-----	1	-----	-----
167	262	157	105	110	72	33	23	12	8	2	2	-----	-----
168	166	121	45	77	38	32	4	10	3	2	-----	-----	-----
169	61	42	19	30	7	8	2	3	2	1	-----	-----	-----
170	16	8	8	7	7	1	1	-----	-----	-----	-----	-----	-----
171	56	35	21	26	15	4	2	2	1	3	3	-----	-----
172	96	59	37	48	31	9	4	1	1	1	1	-----	-----
173	91	52	39	47	37	4	1	1	-----	-----	-----	-----	-----
174	301	198	103	111	55	39	19	28	17	19	12	1	-----
175	176	110	66	67	45	14	8	19	8	10	5	-----	-----
176	84	53	31	34	21	9	5	9	4	1	1	-----	-----
177	605	422	183	237	102	77	36	53	22	53	22	2	1
178	600	417	183	209	93	76	32	51	24	78	33	3	1
179	65	42	23	31	17	4	3	4	2	3	1	-----	-----
180	28	16	12	13	10	2	2	1	-----	-----	-----	-----	-----
181	40	24	16	22	13	2	3	-----	-----	-----	-----	-----	-----
182	40	25	15	22	12	2	2	1	1	-----	-----	-----	-----
183	68	38	30	26	23	7	5	3	1	2	1	-----	-----
184	86	43	43	31	35	8	6	2	1	2	1	-----	-----
185	91	59	32	51	26	3	2	1	-----	4	4	-----	-----
186	5	2	3	2	2	-----	1	-----	-----	-----	-----	-----	-----
187	50	23	22	24	19	4	3	-----	-----	-----	-----	-----	-----
188	257	163	94	108	61	38	23	14	8	3	2	-----	-----
189	152	83	64	62	44	18	13	7	6	1	1	-----	-----
190	118	77	41	56	30	14	7	6	4	1	-----	-----	-----
191	78	55	23	41	16	10	5	2	1	2	1	-----	-----
192	74	51	23	36	15	11	5	2	2	2	1	-----	-----
193	81	55	26	44	17	7	6	2	1	2	2	-----	-----
194	22	14	8	12	7	2	1	-----	-----	-----	-----	-----	-----
195	4	3	1	3	1	-----	-----	-----	-----	-----	-----	-----	-----
196	106	59	47	20	8	7	6	24	23	8	5	-----	-----
197	31	18	13	6	3	2	2	6	5	3	2	1	1
198	13	11	7	7	3	1	1	3	3	-----	-----	-----	-----
199	24	15	9	5	2	7	4	2	2	1	1	-----	-----
200	32	16	16	5	4	4	3	4	5	3	4	-----	-----
201	48	24	24	12	11	4	4	5	6	3	3	-----	-----
202	12	7	5	5	4	1	-----	1	1	-----	-----	-----	-----
203	108	63	40	52	32	5	2	10	5	1	1	-----	-----
204	62	41	21	32	16	4	2	4	3	1	-----	-----	-----
205	38	18	20	7	6	9	12	1	1	1	1	-----	-----
206	68	42	26	33	19	7	5	2	2	-----	-----	-----	-----
207	30	18	12	15	9	3	3	-----	-----	-----	-----	-----	-----
208	48	31	17	25	13	5	3	1	1	-----	-----	-----	-----
209	26	16	10	15	9	1	2	-----	-----	-----	-----	-----	-----
210	32	20	12	15	8	2	2	1	1	2	1	-----	-----
211	49	32	16	24	11	5	30	2	2	12	6	1	-----
212	626	409	217	288	165	70	38	38	16	2	1	1	-----
213	121	80	41	64	34	7	3	7	3	2	1	-----	-----
214	376	221	155	166	119	28	18	18	15	9	3	-----	-----
215	114	77	37	61	27	7	4	7	5	2	1	-----	-----
216	120	75	45	45	27	13	5	11	8	5	4	1	1
217	13	8	5	6	4	2	1	-----	-----	-----	-----	-----	-----
218	102	60	42	41	32	10	6	7	2	2	2	-----	-----
219	23	16	12	11	9	4	1	1	1	-----	1	-----	-----
220	81	47	34	30	27	10	6	5	1	2	-----	-----	-----
221	83	50	33	24	17	9	6	8	4	9	6	-----	-----
222	66	40	26	26	16	4	2	7	6	3	2	-----	-----
223	82	50	32	29	20	10	7	4	2	6	3	1	-----

HIGHWAY TRANSPORTATION SURVEY

Average Daily Density of Loaded and Empty Truck Traffic by Capacity Groups—Continued

Station	Average daily trucks			Average daily trucks by capacity groups									
				1-1½ tons		2-2½ tons		3-4 tons		5-6½ tons		6-7½ tons	
	Total	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty
224	136	74	62	59	49	9	8	4	3	3	2		
225	123	61	62	44	46	10	8	3	4	4	4		
226	77	47	30	38	21	4	5	3	3	2	1		
227	203	131	72	89	52	19	9	12	8	6	2	5	1
228	51	30	21	22	15	3	2	3	2	2	2		
229	183	111	72	77	55	12	7	10	7	7	3	5	
230	35	20	15	15	12	3	2	1	1	1			
231	126	77	49	51	37	17	8	6	4	2		1	
232	188	106	82	74	58	17	13	10	9	5	2		
233	198	109	89	81	66	19	15	7	6	2	2		
234	104	61	43	43	32	11	7	5	3	2	1		
235	42	22	20	14	12	2	1	5	6	1	1		
236	91	57	34	41	26	9	4	3	2	4	2		
237	545	372	173	233	100	76	35	44	21	18	16	1	1
238	430	269	161	199	119	38	20	22	15	10	7		
239	26	15	11	11	9	3	2			1			
240	93	56	37	35	23	13	9	7	5	1			
241	128	80	48	64	38	11	7	5	3				
242	96	58	38	44	30	9	4	4	3	1	1		
243	90	55	35	43	26	8	6	3	2	1	1		
244	103	61	42	47	33	10	5	3	3	1	1		
245	30	19	11	16	9	2	2	1					
246	38	24	14	18	10	3	2	3	2				
247	70	41	29	32	22	6	3	3	2				
248	76	38	38	35	35	2	2	1	1				
249	20	13	7	11	5	1	1	1	1				
250	56	31	25	22	17	6	5	2	3	1			
251	58	31	27	23	23	6	3	1	1				
252	30	18	12	11	7	4	3	3	2				
253	23	11	12	11	8	4	4	1					
254	60	31	29	25	25	4	4	1		1			
255	111	73	38	60	29	9	6	3	3	1			
256	115	71	44	54	34	9	6	5	3	3	1		
257	31	17	14	10	6	2	2	2	3	3	3		
258	229	131	98	85	58	27	21	8	7	11	12		
259	50	31	19	23	13	6	3	2	2		1		
260	59	36	23	29	18	3	1	2	1	2	3		
261	63	47	16	26	11	10	2	1		4	3		
262	96	64	32	58	27	5	3	1	2				
263	136	85	51	66	39	14	7	4	3	1	2		
264	130	75	55	64	43	8	6	3	5		1		
265	37	23	14	19	11	3	1		1			1	1
266	67	43	24	31	15	7	4	4	4	1	1		
267	171	104	67	82	51	15	10	5	3	2	3		
268	140	86	54	61	38	8	6	11	8	6	2		
269	125	87	38	56	25	14	5	9	5	8	3		
270	253	156	97	106	65	22	15	15	7	13	10		
271	212	137	75	103	52	18	12	11	7	5	4		
272	48	30	18	18	11	6	3	3	3	3	1		
273	66	42	24	24	15	6	3	5	2	6	3	1	1
274	110	72	38	50	24	15	7	4	4	3	3		
275	100	62	38	41	27	7	4	5	3	7	3	2	1
276	104	65	39	49	28	5	2	10	8	1	1		
277	186	100	86	71	60	15	14	10	9	3	3	1	
278	51	32	19	26	14	5	3	1	1		1		
279	118	76	42	58	34	11	5	4	2	3			
280	68	42	26	31	20	5	4	3	2	3	1		
281	130	80	50	62	39	11	6	6	4	1	1		
282	32	26	6	20	5	4	1	1		1			
283	35	22	13	18	10	3	2	1					
284	65	45	20	31	10	7	4	6	5	1	1		
285	26	19	7	15	6	3	1	1					
286	44	26	18	20	13	4	3	1	2	1			
287	36	21	15	20	14	1	1						
288	26	17	9	14	7	2	1	1	1				
289	20	18	8	16	7	1	1	1					
290	16	11	5	9	4		1	1		1			
291	92	57	35	39	23	12	8	5	3	1	1		
292	132	74	58	52	38	12	9	6	6	3	4	1	1
293	198	106	92	81	73	17	12	7	6	1	1		
294	43	28	15	22	11	3	2	2	2				
295	22	14	8	10	5	3	3	1					
296	37	20	17	11	9	5	3	4	5				
297	58	33	25	26	21	6	4	1					
298	114	73	41	52	28	16	10	4	3	1			
299	62	28	24	19	13	5	6	3	4	1	1		
300	66	41	25	29	18	9	5	3	2				

Average Daily Density of Loaded and Empty Truck Traffic by Capacity Groups—Continued

Station	Average daily trucks			Average daily trucks by capacity groups									
				$1\frac{1}{2}$ tons		$2\frac{1}{2}$ tons		$3\frac{1}{2}$ tons		$5\frac{1}{2}$ tons		$6\frac{1}{2}$ tons	
	Total	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty	Loaded	Empty
301	74	50	24	29	16	15	7	5	1	1			
302	16	12	4	11	3	1	1						
303	13	12	1	7				5	1				
304	48	32	16	15	7	12	2	5	7				
305	68	41	27	29	17	7	5	4	4	1	1		
306	28	19	9	15	7	1	1	2	1	1			
307	43	27	16	15	13	8	3	4					
308	83	59	24	35	16	12	4	12	4				
309	120	77	43	60	34	5	3	7		5	2		
310	58	30	28	24	24	5	3	1	4		1		
311	62	34	28	24	18	6	7	4	3				
312	114	64	50	49	39	10	6	3	3	2	2		
313	30	16	14	11	9	2	3	1	1	1	1	1	
314	32	15	17	11	13	3	3			1	1		
315	79	48	31	40	24	5	4	2	3	1			
316	132	83	49	69	34	14	8	10	6		1		
317	28	17	11	13	8	3	2	1	1				
318	79	43	36	27	22	10	9	4	3	2	2		
319	94	55	39	37	24	11	8	3	2	4	5		
320	181	104	77	61	34	29	27	9	12	5	4		
321	33	18	15	13	9	2	3	2	2	1	1		
322	50	29	21	24	16	2	3	2	1	1	1		
323	121	61	60	34	36	15	12	7	8	5	4		
324	166	105	61	89	54	11	4	5	3				
325	72	48	24	39	19	8	3	2	2	1			
326	10	7	3	7	3								
327	35	21	14	16	10	2	1	2	2	1	1		
328	44	27	17	18	12	2	1	7	4				
329	12	10	2	10	2								
330	28	16	12	10	9	3	2	2	1	1			
331	61	35	26	22	17	7	5	4	3	2	1		
332	63	37	26	23	15	10	7	3	2	1	2		
333	92	57	35	45	28	8	4	3	2	1	1		
334	40	23	17	16	10	4	3	2	3	1	1		
335	44	25	19	15	12	7	5	2	2	1			
336	136	79	57	49	35	15	11	8	8	5	2	1	
337	132	73	59	42	34	18	12	7	8	6	5		
338	69	42	27	29	17	7	5	4	3	2	2		
339	109	71	38	52	23	8	6	9	6	4	4		
340	186	124	62	73	36	29	9	15	12	7	5		
341	161	99	62	75	47	13	9	9	4	2	2		
342	56	36	20	24	13	6	4	4	2	2	1		
343	65	45	20	33	16	8	2	3	2	1			
344	246	148	98	94	57	24	18	18	13	12	10		
345	25	13	12	4	5	1		6	5	2	2		
346	64	32	32	21	21	3	2	5	5	3	4		
347	126	76	50	52	31	9	4	11	11	4	4		
1348	274	180	94	96	48	40	20	24	17	20	9		
1349	154	85	69	47	40	21	15	11	8	6	6		
1350	274	186	88	100	50	37	16	23	11	23	9	3	2
1351	372	254	118	145	63	50	28	22	14	36	13	1	

APPENDIX IV

Sections of the primary highway system on which the density of motor truck traffic in 1924 was more than
200 per day

Highway section	Route No.	Miles	Daily truck traffic
Harrisburg—Lemoyne	34	1	908
Philadelphia—Chester—Delaware Line	132-180	10	661
Philadelphia—Media	130	7	637
Scranton—Wilkes-Barre	5	17	553
Philadelphia—Willow Grove	151	6	472
Pittsburgh—Springdale	70	15	468
Scranton—Carbondale	6	14	466
Philadelphia—Morrisville	231	13	446
Pittsburgh—Bridgeville	108	5	420
Philadelphia—Coatesville	142	35	411
Wilkes-Barre—Pittston	4-368	7	398
Pittsburgh—East Pittsburgh	120	6	346
Sunbury—Shamokin	161	15	329
Easton—Bethlehem	159	6	297
Scranton—Factoryville	9	11	294
Jct. 4 & 368—Shickshinny	4	18	284
Reading—Womelsdorf	149	13	276
Harrisburg—Clarks Ferry	1	13	271
Altoona—Hollidaysburg	56	4	268
Harrisburg—Elizabethtown	129	16	264
Lock Haven—Mill Hall	58	3	259
Springdale—Butler County Line	70	11	242
Philadelphia—Spring House	153	8	241
Pottsville—Middleport	162	6	238
Reading—Allentown	157	33	233
Hamburg—Pottsville	140-141	21	228
Bridgeville—Washington County Line	108	4	219
Uniontown—Fairchance	116	5	217
Lewistown—Jct. 29 & 192	29	6	212
Reading—Adamstown	148	11	212
Pottsville—Tower City	199	20	206
Reading—Hamburg	160	14	206
Total miles		874	

APPENDIX V

Sections of the primary highway system on which the density of loaded 5 to 7½-ton truck traffic in 1924 was 5 or more per day

Highway section	Route No.	Miles	Daily 5-7½ ton Loaded Trucks
Philadelphia—Chester	180	7	81
Philadelphia—Morrisville	281	13	79
Chester—Delaware Line	132	3	62
Philadelphia—Lansdowne	130	1	56
Philadelphia—Paoli	142	16	51
Paoli—Downingtown	142	12	42
Pittsburgh—Trenton	70	19	26
Downingtown—Coatesville	142	7	24
Philadelphia—Willow Grove	151	6	23
Pittsburgh—East Pittsburgh	120	6	21
Lansdowne—Media	130	6	17
Beaver—Beaver Falls	77	5	16
Scranton—Wilkes-Barre	5	17	16
Easton—Bethlehem	159	6	14
Philadelphia—Allentown	153	41	14
Pittsburgh—Bridgeville	108	5	14
Reading—Temple	157	4	14
Norristown—Collegeville	146	8	13
Reading—Pottstown	146	16	13
Harrisburg—Clarks Ferry	1	13	12
Lancaster—Coatesville	142-215	27	12
Philadelphia—Norristown	145	8	12
Easton—Riegelsville	156	7	11
East Pittsburgh—Irwin	120	8	11
Etna—Bakerstown	72	12	11
Lewistown—junction with road to Shraders	29	6	11
Myerstown—Hershey	139-149	18	11
Wilkes-Barre—West Nanticoke	4	9	11
Willow Grove—Doylestown	151	13	11
Altoona—Hollidaysburg	56	4	10
Harrisburg—Lemoyne	34	1	10
Lancaster—York	128	20	10
Scranton—Blakely	6	6	10 ¹
Trenton—Freeport	70	8	10 ¹
Reading—Myerstown	149	20	9
Scranton—Dalton	9	7	9
Collegeville—Pottstown	146	12	8
Doylestown—Riegelsville	156	23	8
Lancaster—Harrisburg	129	34	8
Philadelphia—Morrisville	150	17	8
West Chester—junction with Rt. 142	143	7	8
West Nanticoke—Shickshinny	4	10	8
Reading—Shillington	148	2	7
Bakerstown—Butler	72	16	6
Beaver—Ohio Line	204	14	6
Beaver Falls—New Castle	77	19	6
Chambersburg—Caledonia Park	43	9	6
Chester—junction with Rt. 130	225	4	6
Irwin—Greensburg	120	9	6
Media—Kennett Square	131	19	6
Norristown—Bridgeport	143	1	6
Pittston—junction with Rt. 4	368	7	6
Carbondale—Blakely	6	8	5
Norristown—junction with Rt. 153	178	10	5
Pottsville—Orwigsburg	140-141	8	5
Reading—Tuckerton	160	3	5 ¹
Scranton—Moscow	168	10	5
Temple—Kutztown	157	10	5
West Chester—junction with Rt. 131	135	7	5
Total miles		644	

¹Estimated.

APPENDIX VI

Average Gross Weight of Loaded Trucks By Capacity Groups,
(81 Weight Stations)

Station	½-1½ tons		2-2½ tons		3-4 tons		5-7½ tons	
	Loaded trucks per day	Average gross weight	Loaded trucks per day	Average gross weight	Loaded trucks per day	Average gross weight	Loaded trucks per day	Average gross weight
		Pounds		Pounds		Pounds		Pounds
1	181	4,730	64	9,690	30	15,060	26	19,030
2	61	5,110	16	10,940	15	16,390	11	20,470
3	134	4,460	56	10,360	24	15,950	14	18,490
4	101	4,420	35	10,380	16	13,340	11	17,990
5	67	4,170	37	12,450	11	16,720	20	22,210
6	57	4,350	16	9,920	7	16,560	6	19,920
7	108	4,450	43	10,150	19	15,100	20	20,340
8	26	4,580	12	10,630	5	17,860	3	18,550
9	13	4,900	3	10,360	2	13,380	1	17,610
10	9	4,590	3	10,100	5	1	4	1
11	148	4,200	46	10,560	30	13,780	16	19,180
12	40	4,390	9	10,010	4	14,910	1	18,810
13	79	4,290	19	10,680	16	14,200	13	20,560
14	47	4,460	10	10,020	7	15,280	9	20,050
15	119	3,710	21	9,980	17	15,860	14	21,960
16	49	3,760	7	11,140	7	15,170	1	15,170
17	65	4,350	11	10,480	5	14,770	1	16,510
18	29	3,820	6	9,760	3	15,520	1	21,680
19	59	4,110	14	10,350	9	14,160	9	19,200
20	29	3,800	7	10,460	4	13,380	3	17,480
21	227	4,060	80	11,490	80	18,140	150	22,530
22	51	4,240	14	11,760	9	17,090	9	22,890
23	13	3,830	6	9,620	6	13,900	1	15,880
24	108	4,300	48	10,390	31	15,030	47	21,330
25	30	3,660	7	9,580	4	13,890	2	17,530
26	58	4,800	28	10,890	5	12,640		
27	69	4,400	13	10,010	5	12,550		
28	46	4,210	9	9,650	2	10,670		
29	78	4,180	12	8,670	3	16,700	4	22,240
30	402	4,240	131	10,460	47	14,740	10	20,060
31	118	4,020	26	10,070	57	19,300	12	20,500
32	103	4,120	27	10,360	18	15,150	9	20,240
33	64	4,210	15	9,890	9	14,440	4	20,420
34	283	3,840	82	9,380	53	14,820	56	20,150
35	199	4,160	53	9,620	42	14,610	62	18,740
36	217	3,710	57	9,270	28	14,580	31	20,330
37	57	4,380	10	9,760	2	15,230		
38	65	4,100	12	11,580	4	16,970	4	21,320
39	106	3,990	11	9,420	4	15,520	2	17,890
40	57	4,100	22	10,890	13	13,970	2	19,830
41	50	4,080	12	9,670	5	13,900	2	17,870
42	62	4,560	22	10,950	11	14,490	1	21,550
43	41	4,640	13	10,340	6	13,470	1	18,110
44	40	3,860	7	9,940	4	15,350	6	22,830
45	33	5,100	13	10,420	10	15,310	9	18,010
46	53	4,240	7	9,620	7	14,830	1	20,320
47	40	4,740	11	10,300	2	14,650		
48	204	3,900	29	9,710	22	14,070	5	17,720
49	164	4,630	28	10,140	15	15,150	6	19,500
50	66	4,100	10	10,450	12	16,680	5	19,890
51	65	3,920	23	10,210	19	15,700	16	20,160
52	36	4,060	9	9,800	7	15,280	3	17,950
53	53	4,340	12	9,530	5	13,400	3	17,210
54	38	4,420	5	11,680	2	11,940		
55	77	4,150	17	9,800	10	12,970	15	20,190
56	183	4,010	33	10,580	30	16,670	11	21,190
57	42	4,470	10	10,400	7	15,700	3	19,770
58	177	3,890	38	9,840	21	14,790	6	19,560
59	107	4,130	20	9,670	5	13,470	1	17,700
60	37	4,310	6	10,750	4	13,160	1	17,360
61	91	4,040	11	9,680	5	14,840	2	19,800
62	47	4,010	20	10,660	8	13,500	12	19,720
63	140	3,890	39	9,940	23	15,210	23	19,800
64	51	4,180	14	10,620	8	14,270	13	20,780
65	63	3,560	16	10,250	7	14,430	11	20,250
66	114	4,340	38	10,660	16	14,950	14	20,100
67	131	3,860	24	9,900	11	13,120	2	19,280
68	30	4,240	5	9,410	1	11,260	1	18,100
69	153	4,270	26	10,420	18	14,800	5	19,310
70	78	4,290	13	10,080	7	12,620	3	18,910
71	73	3,580	9	10,400	5	13,000	3	18,320
72	49	4,450	16	10,380	6	14,340	2	19,930
73	31	4,650	5	10,080	3	16,350	1	15,140
74	38	4,320	4	9,300	1	13,350	1	21,410
75	90	3,730	12	10,240	1	14,110	1	17,080
76	25	4,010	9	10,130	5	13,910	3	17,810
77	38	4,300	11	9,790	5	14,690	3	18,840
78	67	3,710	9	9,140	5	12,820	2	15,160
79	65	4,430	19	10,520	14	16,110	10	21,160
1348	96	4,400	40	9,540	24	15,390	20	18,700
1350	100	4,100	37	9,510	23	14,010	26	20,120

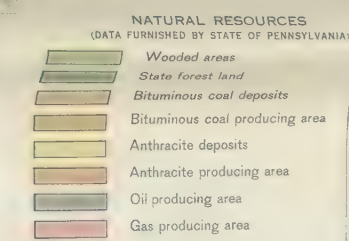
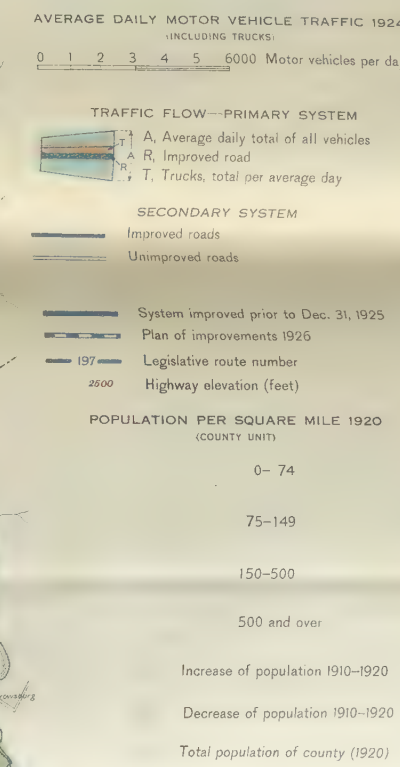
¹Gross weight not available

APPENDIX VII

Average Daily Density of Loaded Truck Traffic by Gross Weight Groups
(81 Weight Stations)

Station	Daily loaded trucks by gross weight					
	Total	Under 6,000 Pounds	6,000-11,999 Pounds	12,000-17,999 Pounds	18,000-23,999 Pounds	24,000 pounds and over
1	301	146	99	34	18	4
2	103	43	31	14	12	3
3	223	111	70	31	14	2
4	163	85	49	21	7	1
5	135	63	23	26	16	7
6	86	50	21	8	6	1
7	190	89	57	23	15	6
8	46	20	15	6	5	
9	19	9	7	2	1	
10	21	13	7	1		
11	240	128	62	35	12	3
12	54	35	13	5	1	
13	127	66	32	16	10	3
14	73	37	19	9	6	2
15	171	108	31	15	11	6
16	64	45	10	7	2	
17	82	55	19	7	1	
18	39	27	7	4	1	
19	91	52	20	10	6	1
20	43	26	10	6	1	
21	537	200	88	76	94	79
22	83	43	16	11	10	3
23	31	16	8	6	1	
24	234	93	59	40	23	19
25	43	28	10	4	1	
26	91	45	35	11		
27	87	58	24	5		
28	57	40	14	3		
29	97	68	22	3	3	1
30	590	345	160	64	19	2
31	213	105	38	20	43	7
32	157	92	35	20	7	3
33	92	55	23	9	4	1
34	474	263	105	54	41	11
35	356	174	78	56	42	6
36	333	206	68	32	17	10
37	69	47	18	3	1	
38	85	57	16	7	3	
39	123	94	22	5	2	2
40	94	49	26	16	3	
41	69	45	17	6	1	
42	96	48	31	14	3	
43	61	33	20	7	1	
44	57	35	12	3	4	3
45	65	31	21	9	4	
46	68	45	16	5	2	
47	53	30	18	5		
48	260	182	53	18	6	1
49	213	132	56	18	6	1
50	93	56	20	10	6	1
51	123	59	28	19	15	2
52	55	31	13	7	4	
53	73	45	20	6	2	
54	45	31	10	3	1	
55	119	64	30	14	8	
56	257	159	51	26	16	3
57	62	34	16	8	3	5
58	242	158	54	21	8	1
59	133	95	29	8	1	
60	48	32	10	5	1	
61	109	83	18	7	1	
62	87	41	23	15	5	3
63	225	128	48	28	15	6
64	86	43	20	13	6	4
65	97	58	19	12	6	2
66	182	96	48	25	10	3
67	213	161	43	11	3	
68	37	26	9	1	1	
69	202	126	50	19	6	1
70	101	66	26	7	2	
71	90	68	14	6	3	
72	73	41	21	8	3	
73	40	24	12	3	1	
74	44	31	9	2	1	1
75	104	81	18	5		
76	42	22	12	6	2	
77	57	31	16	7	3	
78	83	63	15	4	1	
79	108	54	27	14	9	4
1348	180	82	55	26	12	5
1350	186	91	48	26	16	5

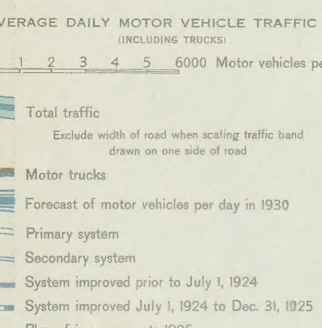
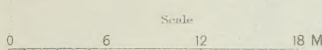
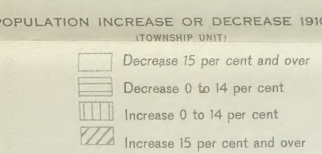
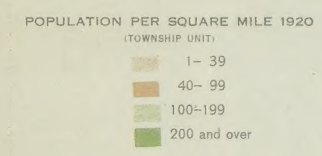
HIGHWAY TRANSPORT SURVEY
OF
PENNSYLVANIA
VOLUME AND CHARACTER OF MOTOR TRAFFIC ON
MAIN STATE HIGHWAYS AND ITS RELATION
TO POPULATION, NATURAL RESOURCES
AND INDUSTRIES



PREPARED BY COOPERATING AGENCIES—
Pennsylvania Department of Highways and
United States Bureau of Public Roads.

HIGHWAY TRANSPORT SURVEY
OF
PENNSYLVANIA

VOLUME AND CHARACTER OF MOTOR TRAFFIC ON
STATE HIGHWAY SYSTEM AND ITS RELATION
TO POPULATION



PREPARED BY COOPERATING AGENCIES—
Pennsylvania Department of Highways and
United States Bureau of Public Roads.

